Edited by Richard Dumbrill

Prima la musica e poi le parole

Proceedings of the International Conference of Near Eastern Archaeomusicology

ICONEA 2009 - 2010

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and at
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Foreword

ICONEA 2009 was held at la Maison de la Recherche of the Université de la Sorbonne. The theme was Sumerian and Akkadian comparative philology/organology. Most of the debates were centralised on Theo Krispijn's work which had been published earlier in the proceedings of ICONEA 2008. During these three days of research, Krispijn presented the evidence for percussion instruments and I presented evidence for chordophones. Finkel proposed alternative understanding of early pictographs: what did they really represent and from which perspective should they be viewed. We arrived at the conclusion that in the absence of sufficient material, it is very difficult to isolate, indubitably, most instruments for a period of about three millennia.

For that reason, the editorial board of ICONEA decided not to publish the proceedings for that conference until further developments arise.

ICONEA is now a research group of the Institute of Musical Research, School of Advanced Study of the University of London. The 2010 conference was held at the Chancellor's Hall, Senate House, University of London and attracted leading scholars specialists of the Hyksos – and around the Hyksos period. Over ten countries were represented and much was learnt, ranging from cheironomic instructions to dance, to conch trumpets used as communication devices, etc. The proceedings are published in the present volume.

During the past year, ICONEA produced three public seminars per term. These have proven to be very successful and will therefore be continued in the future. Bruno de Florence gave a series of talks on the epistemological framework of music, from Aristotle to Descartes and Lacan. This attracted a great diversity of scholars ranging from theoreticians to analysts. His seminars will continue throughout the academic year and will be published in due time as a separate issue of ICONEA.

I introduced archaeomusicology at the University of Uludağ, in Bursa, Turkey, last Spring and we are currently drawing agreements with the department of archaeology for future academic exchanges between our two institutions. This aims at the creation of a sub-department of archaeomusicology at Bursa. It was also agreed that both institutions will jointly organise a conference in October 2012 on Bronze and Iron Age archaeomusicology in Ancient Turkey. Margaux Bousquet and myself attended the Damascus conference ORIENTAL LANSCAPES in May, organised by Hannibal Saad and the ministry of Culture. This conference attracted leading scholars of ethno and archaeomusicology. It was held mainly at the Dar al-Assad Opera House of Damascus. Concerts were given by soloists and ensembles such as the Damascus Festival Chamber Players; The Group Maqam of Syria; Hassan Taha, Syria; Zaid Jabri, Syria; Chafi Badreddin, Syria; Diaa Sukkary, Syria; Kinan Azmeh, Syria; Maias Yamani, Syria; Nouri Iskandar, Syria; Ibrahim Kevo, Syria; Indrani Mukherjee, India; Bushra Bashalani, Lebanon; Taisir Khalaf, Syria; The Byzantine Choir of St Romanos the Melodist of Homs; the Koukouyo Choir of the Syriac Church; Apurba Mukherjee, India; Essam Rafea, Syria; Omar Sarmini, Syria; the Nawa Band; The Annunciation Band; Fikret Karakaya, Turkey; Kinan Idnawi, Syria; Muhammad Qadri Dalal, Syria; Mohammad Mo'tamedi, Iran; Nidaa Abu Mrad, Lebanon; Yulduz Turdieva, Uzbekistan.

The Sham Dervish Ensemble, Syria; Fira Shahrstan. Among ethno - archaeomusicologists were Jean During, CNRS France; Jameel Wilaya, Syria; Archbishop Joseph Absi, Syria; Hussain al-Aadhamy, Iraq; Richard Dumbrill, UK; Margaux Bousquet, France; Samim al-Sharif, Syria; Fira Sawah, Syria; Frederic Lagrange, France; Fawaz Baker, Syria; Mahmoud Guettat, Tunisia. I made my way to Beirut and spent a week with my colleague and friend Amine Beyhom. This led to the creation of NEMO-Online, a new research pool on Near Eastern Music with a review both available as a hard copy and online. ARANE publications have now been incorporated to NEMO-Online.

We are delighted to announce that Philippe Brunet member of ICONEA and of the academic board of NEMO-Online was awarded a silver medal for the Prix Jules Janin at the Academie Française for his recent translation of Homer's Iliad. Xavier Fresquet was awarded a Doctorate with 'mention très honorable' at the Université de la Sorbonne, on mediaeval zithers. The Jury which I presided was composed of Professor Frédéric Billiet, Dean of the UFR Music and musicology of the Sorbonne University and Madame la Professeure Marie-Bernadette Dufourcet-Hakim, thesis supervisors; Professors Florence Gétreau (CNRS), Isabelle Marchesin (Bordeaux) and Richard Dumbrill (London).

Jessica Hale is studying at SOAS for a MMus., a prelude to her doctoral thesis in archaeomusicology which she will defend at the Sorbonne. Margaux Bousquet is concluding her doctoral thesis, also at the Sorbonne.

ICONEA 2011 which was about the Oud from its Sumerian origins to modern times was a great success.

Richard Dumbrill

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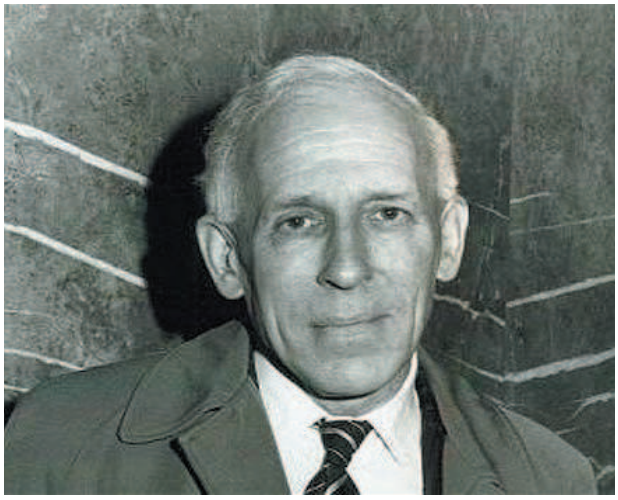

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EGYPTIAN FRACTIONS AND THE ANCIENT SCIENCE OF HARMONICS

Leon Crickmore

There is a growing body of evidence to support the hypothesis that in ancient times there existed throughout the Near East a common mathematical approach to the definition of musical pitch in terms of ratios of pipe or string-length. This tradition became known by the time of Plato as the science of harmonics. As a branch of music theory, harmonics probably originated in Mesopotamia. It would later have been transmitted to Greece and Egypt. As performing musicians were traded widely by kings between the temples and palaces of cities across the Near East, they would have taken their knowledge of music theory with them. It seems reasonable therefore to assume that the science of harmonics would then have been accommodated to the various regional systems of arithmetic in use: sexagesimal in Mesopotamia; Pythagorean in Greece and in Egypt by means of Egyptian fractions.

Egyptian fractions

The main source of our knowledge about Egyptian mathematics is the Rhind Papyrus (*ca.*1550 B.C.) which has recently featured as item 17 of the British Museum's A History of the World in 100 Objects.

Mathematicians in ancient Egypt used unit fractions (or reciprocals) in the form 1/n. Most other fractions had to be expressed as the sum of a number of unit fractions. For instance, 15/16 could be written as 1/2 + 1/4 + 1/8 + 1/16. Additionally, however, they did have a hieroglyph for 2/3, and the Rhind Papyrus also includes a 2/n table for odd values from 3-101. While every fraction is now known to have an infinite number of possible expressions as an Egyptian fraction, the mathematicians of ancient Egypt were adept at optimizing the fractional form to match its particular practical usage, as well as of finding the relevant Egyptian fraction with the smallest denominators. In a similar way, the music theorists of ancient Greece were skilled in calculating the smallest possible integers by which a musical interval could be expressed as a ratio. The restriction by the mathematicians in ancient Egypt of fractional calculations almost exclusively to the use of unit fractions may initially seem to us a rather primitive form of arithmetic. But it was in fact both fit for purpose and highly practical in ancient Egyptian society. This can be seen in the arithmetic of their astronomy, their calculation of the start of spring and their geometry for building. I shall cite one simple example of the practicality of calculating by means of the sum of a number of unit fractions. To divide 5 loaves between 8 people, it is necessary to give each 5/8 of the bread. Expressed as an Egyptian fraction 5/8 = 1/2 + 1/8. Halve therefore each of the five loaves and distribute them amongst the 8 people. If each person is now given 1/8 of the remaining loaf, the practical problem of distribution is solved. In short, then, we can define an Egyptian fraction as the expression of any fraction as the sum of a number of unit fractions of the form 1/n.[1]

The ancient science of harmonics

In the modern world musical pitch is defined by frequency and usually expressed in Herz (Hz.) which signify vibrations per second. The ancients, however, were unable to measure frequency accurately, though it seems they had some conception of 'inferred vibration'. In the ancient world relative musical pitch was defined by ratios of string or pipe length. One of the earliest discoveries of primitive empirical science must have been that if one doubles

the length of any vibrating string (keeping all other factors constant), the resulting sound would in one respect be the same and in another respect different. We would express this by saying that the pitch classification would remain unchanged, but that the octave at which it is sounded would be different. Doubling a string length lowers its pitch by an octave; halving it raises the pitch by the same interval. If such a relationship were to be formulated numerically in ratios, it would read 2 : 1 :: 1 : ½. It seems possible that such an expression may be the origin from which the ancient Greek double - octave system, known as the Greater Perfect System, later evolved. It will be noticed that unity (sometimes called the Monad by the ancients) is the fulcrum of this structure, as it was of all ancient mathematics. In modern times, the fulcrum of our arithmetic is zero, which was unknown as a number to the ancients. From zero a series of positive numbers rise in one direction: 1, 2, 3, 4; while a series of negative numbers fall in the opposite direction: -1, -2, -3, -4. While ancient mathematicians shared the rising arithmetic series: 1, 2, 3, 4, they mirrored it with a descending harmonic series: 1, 1/2, 1/3, 1/4. A modern acoustician can therefore confidently say: 'frequency of vibration varies in inverse proportion to string-length'. His ancient counterpart, on the other hand, might rather have said: a proportionate increase in string length by 2:1 lowers the pitch of the sound produced by the same interval as a reciprocal shortening of the string in the ratio 1:2 will raise it.

Our modern scales are usually tuned to what is called 'equal temperament'. The octave is divided into twelve semitones, each of which is equal. Mathematically, the equal-tempered scale lies on a logarithmic spiral. The frequency of each subsequent semitone is therefore generated by an increase of the twelfth root of two. But the ancient mathematicians, had no logarithms.

Their calculations of the ratios between the tones and semitones of their scales tended to be closer to the harmonic series, which corresponds to the natural vibrations into which any musically resonant body will fall. Thus we find Pythagoras being credited with the discovery of the basic concords: the octave 2:1; the perfect fifth 3:2 and the perfect fourth 4:3.

It will be noticed that these three ratios are all made up of the numbers 1, 2, 3, 4, which together form the Pythagorean tetractys. Traditionally, the tetractys was represented by an array of pebbles in the form of a perfect triangle, whose four rows were associated respectively with a point, a line, a plane and a solid. But until recently its musical and harmonic significance has been sadly neglected by classical scholars. To explain this we need to consider what musicologists sometimes call the 'musical tetractys': 12 : 9 : 8 : 6.

Harmonics in ancient Greece

When discussing in his Republic[2] the curriculum necessary for the training of the best kind of political leaders (that is, philosopher-kings), Plato includes 'harmonics' in his list of mathematical sciences. He argues that the audible movements which produce musical consonances are only 'imperfect reproductions of those mathematical movements from which result mathematical consonances'. It is the pure mathematical patterning of the latter with which the true student of harmonics should be concerned. In ancient times there was a considerable overlap between music and cosmological science. The 'Music of the Spheres' – now little more than a poetic image – was then a form of primitive cosmological science. The sounds generated by the speeds of revolution of the seven planets were believed to correspond to the notes of a heptachordal scale. Later, the fixed stars were accorded a note of their own, and the music of the spheres was considered to be an octave species or mode.[3]

For an explanation of the calculation of the 'tone-numbers' – that is the notional string-lengths required to generate a particular relative pitch – of a complete diatonic scale, with the ratios between them, we have to turn to Plato's Timaeus.[4]

According to Plato, all living creatures have a 'soul'. In the relevant passage in the Timaeus, he is explaining by means of a myth how the demi-urge created the 'World Soul'. The patterning of a number of ancient myths seems to mirror musical intervals and scales in a manner which justifies some such terminology as 'harmonic mythology'.[5] Plato's 'World Soul' is a prime example of such a myth, since it has the form of four octaves and a major

sixth of a falling diatonic scale. The tone-numbers of this scale are generated from a series of powers of two and of three. Theon,[6] writing in the second century A.D., describes in detail three 'medians' or 'means' essential to the understanding of ancient mathematics: the arithmetic (a + b)/2 - the only one of the three still commonly used in modern mathematics for calculating a statistical average; the harmonic (2ab)/a + b; and the geometric $\sqrt{ab}$. In the Timaeus 31c, Plato describes the geometric mean as the 'fairest of bonds'. In a two-octave scale, such as the Greek Greater Perfect System, for instance, the central tone-number will always be the square root of the product of the two outermost tone-numbers: a splendid example of a geometric mean. To create the 'World Soul' the demiurge fills up the gaps in the series of powers of two and three already mentioned by means of harmonic and arithmetic means. For example, if the harmonic and arithmetic means are placed between 1 and 2, we get 1 : 4/3 :: 3/2 : 2. By convention, tone-numbers had to be integers. So each of these terms must be multiplied by 6, resulting in 6 : 8 : 9 : 12. These four tone-numbers define the so-called 'fixed' tones of ancient Greek scales and the tonic, sub-dominant, dominant and tonic octave of our modern diatonic scale. When the tone-numbers of the entire four-five octave scale have been calculated in this manner, the tone numbers of the first octave will have been multiplied up to 384 : 432 : 486 : 512 : 576 : 648 : 729 and 768.

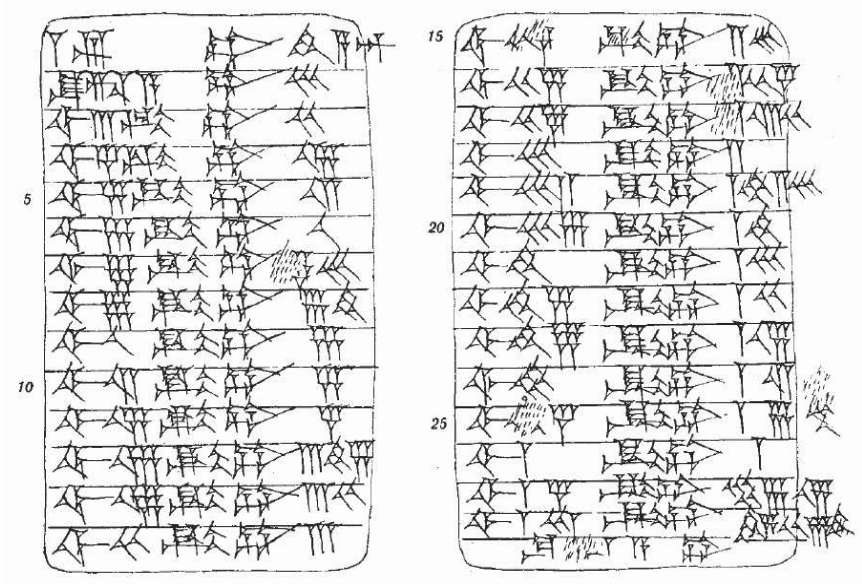
From this we can derive the ancient Greek ratio for a tone: for example, 432/384 = 9:8; and of a semitone: 512/486 = 256 : 243. Any initial puzzlement about the size and apparent complexity of this latter ratio disappears when we realise that $256/243 = 2^8/3^5$. In ancient Greece, all the tone-numbers of diatonic scales are generated by integers in the form 2^p3^q.

To summarize: the ancient science of harmonics was the theoretical arithmetic underpinning the tuning of musical instruments in ancient times. It was a numerical science based on ratios of pipe or string length.[7]

Harmonics in Mesopotamia

One of the most significant developments in recent musicology has been the transcription and interpretation of a number of Mesopotamian musical cuneiform tablets dating from the second millennium B.C.[8] These documents are the source of our knowledge of music theory concerning the tuning of instruments and the structure of the Mesopotamian heptachordal scales. But no cuneiform tablet has yet been transcribed which indicates the quantitative tuning of tones and semitones corresponding to the Greek evidence in Plato's Timaeus. If the music theorists of ancient Mesopotamia did in fact possess a mathematical science of harmonics, it would have been expressed in their sexagesimal arithmetic. Tone-numbers would not have been restricted, as in Pythagorean tuning, to numbers in the form 2^p3^q, but would have included multiples of 5. Robson[9] informs us that 'reciprocal pairs' played a significant role in Mesopotamian mathematics. She quotes evidence from the scribal schools of 19th and 18th century Larsa, Ur and Nippur, where thousands of practice copies the standard tables of reciprocals have survived. These tables normally contain thirty regular numbers (that is numbers in the form $2^p3^q5^r$) between 2 and 81, together with their reciprocals in sexagesimal arithmetic. If the regular numbers in these tables are interpreted as tone-numbers, representing the notional length of a string or pipe required to produce a given relative pitch, then everyone would produce a musical sound, while the range 24-81 could generate all seven of the Mesopotamian heptachords in both a downward and an upward direction. The reciprocals of the relevant numbers would produce the same modal patterns in the opposite direction. Figure 1 shows an example of such a table, with its scalar section (24-60) highlighted.

These tables would be used for division. To divide a number, using one of the regular numbers in such a standard table as the divisor, a trainee scribe would have simply multiplied the dividend by the reciprocal of the divisor. The trainee scribes would have been expected to learn these tables by heart. My hypothesis is that these standard tables would probably have also been used in music theory to define the intervals of the Mesopotamian diatonic seven-note scales. If so, there would have been two sizes of tone: 9:8 as in Greece; but also 10:9. Semitones would have been much more varied than the Greek 256:243. Their value might be 16:15, 27:25 or 25:24.



Two thirds of 1 is 0;40
Its half is 0;30
The reciprocal of 2 is 0;30
The reciprocal of 3 is 0;20
The reciprocal of 4 is 0;15
The reciprocal of 5 0;12
The reciprocal of 6 is 0;10
The reciprocal of 8 is 0;07 30
The reciprocal of 9 is 0;06 40
The reciprocal of 10 is 0;06
The reciprocal of 12 is 0;05
The reciprocal of 15 is 0;04
The reciprocal of 16 is 0;03 45
The reciprocal of 18 is 0;03 20
The reciprocal of 20 is 0;03

The reciprocal of 24 is 0;02 30
The reciprocal of 25 is 0;02 24
The reciprocal of 27 is 0;02 13 20
The reciprocal of 30 is 0;02
The reciprocal of 32 is 0;01 52 30
The reciprocal of 36 is 0;01 40
The reciprocal of 40 is 0;01 30
The reciprocal of 45 is 0;01 20
The reciprocal of 48 is 0;01 15
The reciprocal of 50 is 0;01 12
The reciprocal of 54 is 0:01 06 40
The reciprocal of 1 00 is 0:01
The reciprocal of 1 04 is 0;00 56 15
The reciprocal of 1 21 is 0;00 44 26 40
<Its half>

Figure 1. MCL 1670, after Clay. An example of a Mesopotamian standard table of reciprocals.

	Tones	Semitones
Mesopotamia	9:8 10:9	16:15 25:24 27:25
Creece	9:8	256:243
Equivalent Egyptian Fractions / Reciprocals (Reciprocal form of ratios shown first)	8:9 = 1/2 + 1/3 + 1/18 9:8 = 1 + 1/8 9:10 = 1/2 + 1/3 + 1/15 10:9 = 1 + 1/9 + NB RMP Table of 2/n	15:16 = 1/2 + 1/4 + 1/8 + 1/16 16:15 = 1 + 1/15 24:25 = 1/2 + 1/4 + 1/5 + 1/100 25:24 = 1 + 1/24 25:27 = 1/2 + 1/4 + 1/6 + 1/108 27:25 = 1 + 2/25* 243:256 = 1/2 + 1/4 + 1/6 + 1/32 + 1/768 256:243 = 1+ 13/243

Figure 2. Transmission of the science of harmonics through the trading[10] of musicians and the re-expression of music theory in regional arithmetics.

The resulting tuning, therefore, would be what we now call 'Just tuning' rather than Pythagorean. All these ratios, both Mesopotamian and Greek, can also be expressed as Egyptian fractions. This is shown in figure 2, using the shortest fractional forms.

Application to modal scales

Figure 3 indicates how a single ancient musical scale can be defined in accordance with Greek, Mesopotamian and Egyptian arithmetic so as to form a consistent science of harmonics.

At the top of figure 3 there is the modern letter-name notation for the falling first octave of the 'World Soul' scale. This also turns out to be the Dorian octave species, which together with the Phrygian are the only two musical modes that Plato will allow into his ideal republic (Republic, 398-99c). While in the Laches (188d), he envisages a virtuous man 'rendering his own life harmonious by fitting his deeds to his words in a truly Dorian mode, not in the Ionian, or even, I think, in the Phrygian or Lydian, but in the only harmony that is genuinely Greek'.

Below and between the letters signifying musical pitches are the ratios of string–length defining the tone and the semitone from the Timaeus, which were considered earlier. Finally in the Greek section of the figure come the tone-numbers which define this scale in Pythagorean tuning, and which were calculated by inserting harmonic and arithmetic means between a series of powers of two and three. In the Mesopotamian section of the figure, we have the comparable tone-numbers in just tuning, with the appropriate ratios of string-length between and below. Next come the smallest integers capable of defining the same scale in reciprocal ratios of string-length. All these numbers are smaller than the Greek ones on account of the use of five as a multiplier. The first seven tone-numbers define the falling Mesopotamian heptachord *nīd qablim*. To transpose each of the Greek tone-numbers into the Mesopotamian, one has to divide the former by 16 (2^4). However, in the case of each of the three numbers underlined, the result is not an integer. For example, 648 divided by 16 = 40.5. But when 40.5 is multiplied by 80/81, the required number 40 is reached. This is not special pleading. Indeed the final two regular numbers in many of the Mesopotamian standard tables of reciprocals are 80 and 81. Modern acousticians refer to 80/81 as the 'syntonic comma'. It is the difference between a Pythagorean ditonic third (81/64) and a Just-tuned pure third (5:4). The idea that the quantification of this subtle tuning distinction was recognised in ancient times is not necessarily wishful thinking. For Friberg[11] cites a mathematical problem from the Seleucid text AO 6484:7:

In this exercise, the terms igi and igi.bi denote a reciprocal pair of (positive) sexagesimal numbers such that their product is equal to 1 (any power of 60). Friberg gives the solution of the problem as: 'igi' = 81/80 and 'igi.bi' = 80/81. A correspondent recently wittily reminded me how easily Pythagorean tuning can thus be 'ad-just-ed'.

Other relevant features of Egyptian mathematics

(1)In ancient Egyptian mathematics multiplication was achieved by a process of repeated doubling (duplatio) of the number to be multiplied. This was then set alongside the same process carried out from unity: a geometric progression from 2. Every integer can in fact be expressed as the sum of numbers in the form 2^p. Next, a set of powers of two which add up to the multiplier are identified and isolated. A process of addition of the corresponding items in the first column then yields the answer. Multiplication by duplatio is illustrated in figure 4.

(2) Plato's 'World Soul' has the mathematical structure of a diatonic musical scale. The Egyptian myth of the 'Eye of Horus' provides a further example of harmonic mythology. Its mathematical structure is a geometric progression starting from the reciprocal of 2 (1/2).

Musically, this defines a series of rising octaves in fractions of string-length. Osiris was murdered by his brother, Seth. During one of the fights between Seth and Horus, Seth ripped out the eye of Horus, divided it into six pieces and dispersed them around Egypt. Later, by command of the gods, the eye of Horus was reassembled and became a talisman for health and wholeness, as well as a practical symbol of fractional measures of volume.

															Greek		
E'		D		C		B		A		G		F		E			
	9:8		9:8		256:243		9:8		9:8		9:8		256:243				
384		432		486		512		576		648		729		864			
															Mesopotamian		
24		27		30		32		36		40		45		(48)			
	9:8		10:9		16:15		9:8		10:9		9:8		(16:15)				
60		54		48		45		40		36		32		(30)			
	9:10		8:9		15:16		8:9		9:10		8:9		(15:16)				
1/2+1/3+1/15			1/2+1/3+1/18		1/2+1/4+		1/2+1/3+1/18		1/2+1/3+1/15		1/2*1/3+1/18		1/2+1/4+		Egyptian fractions		
					1/8+1/16								1/8+1/16				
72		80		90		96		108		120		135		(144)	Greek/Mesopotamian		
	10:9		9:8		16:15		9:8		10:9		9:8		(16:15)		reciprocal ratios		
1		1+1/9		1+1/4		1+1/3		1+1/2		1+1/2+1/6		1+1/2+1/4		2	Egyptian fractions		
												+1/8					
1/2		5/9		5/8		5/9		3/4		5/6		15/16		11	Modern fractions of 144		

Figure 3. The Dorian octave species/*nid qãblim* heptachord in three arithmetics.

The six pieces were the reciprocals of a geometric progression from base 2: ½ ¼ ⅛ 1/16 1/32 1/64.

In the arithmetic of harmonics, these unit fractions define a series of musical octaves. The 'eye' (shown below right) is composed of Egyptian hieroglyphs, corresponding to the values of these six reciprocals. Their sum is slightly less than unity. The difference –that is subtract 1/64, or multiply by 63/64 (the sum of the six pieces)- can be conceived as a kind of Egyptian version of the Pythagorean comma (524288/531441, which is $2^{19}/3^{12}$, or approximately 73/74). The Pythagorean comma measures the difference between six tones $(9/8)^6$ and an octave 2:1. Six tones: $(9/8)^6 = 2.0272$, while 2.0272 x 63/64 is almost 2 = an octave.

(3) The Rhind papyrus contains many so-called 'auxiliary numbers' written in red ink. Although these auxiliary numbers have long been understood to have some connection with Lowest Common Multiples (LCMs), it is only in the last few years that mathematicians have fully discovered how to parse their various uses. Auxiliary numbers are rational numbers in the form n/p, scaled by an LCM to mn/mp.

25 x			18 $(2^1 + 2^4)$
		1	
1st doubling	50 ($25x2^1$)	2	
2nddoubling	100 ($25x2^2$)	4	50 + 400 = 450
3rddoubling	200 ($25x2^3$)	8	(25 x 18 = 450)
4thdoubling	400 ($25x2^4$)	16	
Multiplication by duplatio			

Figure 4. Multiplying 25 by 18 through 'doubling' (duplatio).

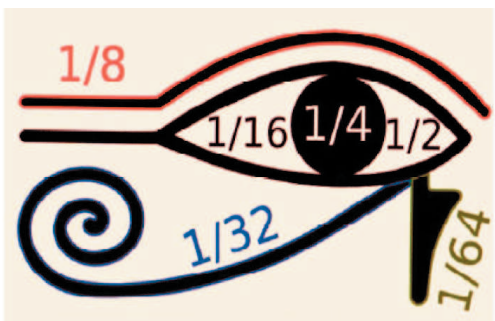


Figure 5. The Eye of Horus.[12]

72		80		90		96		108		120		135		144	Tone-numbers
	10:9		9:8		16:15		9:8		10:9		9:8		16:15		Ratios
1/2		5/9		5/8		5/9		3/4		5/6		15/16		1	Fractions of 144
1		1+1/9		1+1/4		1+1/3		1+1/2		1+1/2+1/6	1+1/2+1/4+1/8			2	Egyptian fractions
E'		D		C		B		A		G	F			E	Pitches

Figure 6. The falling Dorian octave species in smallest integers.

To take an example from the Rhind papyrus (37), which shows how any series of unit fractions can be individually inverted to a red number numerator: 1/4 = 72/288, where n/p = 1/4 and 4 x 72 = 288.[13] This example is likely to be of particular interest to musicologists with an interest in harmonics, since 72 is smallest integer from which the Dorian octave species and *nīd qablim* heptachords can be defined in ratios of string length, with 288 two octaves above.[14] Ernest McClain[15] has written:

> *Egyptian mathematics is in many ways the mathematics of the monochord student and instrument-maker, of the ancient harp-maker and later organ-builder, of the musical-theorist and the carpenter alike down through the ages which lacked a finely graduated and fixed metric scale and the convenience of slide rule and logarithmic tables.*

In his erudite book The Mathematics of Plato's Academy,[16] David Fowler proposes an entirely new reconstruction of the history of ancient Greek mathematics. He points out that our evidence that ancient Greek mathematicians used 'common fractions' is derived exclusively from mediaeval sources, whilst the papyrological evidence suggests that in their arithmetic they normally used Egyptian unit fractions. He also argues that the Greeks may not have used 'ratios' in the same manner as we have come to understand them as a consequence of nineteenth century mathematics. According to Fowler, the ancient Greek mathematicians' most important concept of 'ratio' was what he calls 'anthyphairetic': a kind of 'reciprocal subtraction'.[17] He does, however, concede the likelihood of some use of traditional ratios in music theory.

Conclusion

Historians of mathematics have tended to conclude that ancient Egyptian mathematicians lacked the sophistication of their Mesopotamian counterparts. Egyptian mathematics was certainly a more utilitarian form of arithmetic. But such a 'weakness' (if a weakness it be) could also be considered as 'strength' in terms of its usefulness to ancient instrument-makers and music theorists. It seems distinctly probable that the arithmetic of harmonics originated in Mesopotamia, was rationalized in Greece and brought to Egypt by the trading of musicians. If this were so, some of the later monochord calculations, together with those needed for the holing of pipes or the fretting of string instruments, would be likely to have been carried out using Egyptian fractions – certainly in ancient Egypt, but also (if David Fowler is right) in ancient Greece.

Notes

1 http://www.maths.surrey.ac.uk/hostedsites/R.Knott/Fractions/egyptian.html

2 Adam, J. (1902) *The Republic of Plato*, Vol.II, Cambridge University Press: 530c-31c.

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4 *Timaeus*, 34-7.

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10 Franklin, J. C. (undated) Capsule E3Th7ANEMusic

11 Friberg, J. (2007) Amazing Traces of a Babylonian Origin in Greek Mathematics, *World Scientific*: 67-8.

12 Image from http://en.wikipedia.org/wiki/File:Oudjat.SWVG – attribution: Benoit Stella alias BenduKiwi

13 72/288 = (9 + 18 + 24 + 3 + 8 + 1 + 8 +1)/288 = 1/32 + 1/16 + 1/12 + 1/96 + 1/36 + 1/288 + 1/36 + 1/288.

14 Adrastus of Aphrodisias (2nd century A.D.) seems to have divided the monochord linearly into 72 units. Creese, D. (2010) *The Monochord in Ancient Greek Harmonic Science*, Cambridge University Press: 245-7.

15 McClain, E.G. (1976) *The Myth of Invariance*, Nicolas-Hays, Inc: 179.

16 Fowler, D. (1999) *The mathematics of Plato's Academy: A New Reconstruction*, 2nd Edn, Clarendon Press.

17 E.g. 22:6 would mean: subtract 6 from 22 3 times; 4 remains; subtract 4 from six 1 time; 2 remains; subtract 2 from 4 2 times. 26:6 is (3, 1, 2).

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HAND POSITION OF MUSICIANS BEFORE AND AFTER THE HYKSOS KINGS

Magdalena Kuhn

The richness and diversity of the iconography has shown that music played an important part in the life of Ancient Egyptians, unsurprisingly, as it did in the life of all past civilisations.

Unlike with the Ancient Near and Middle East where the archaeology has produced textual evidence of theory and of music, Ancient Egypt has to this day remainded sterile with it. Therefore scholars need to rely on other sources for their understanding of the music from this ancient culture.

Hickman[1] was of the opinion that Ancient Egyptian artists were rigorously accurate in their scaling of musical scenes. He measured string lengths of chordophones and air columns of aerophones and of other instruments and compared them, somehow, to mural paintings where musicians, as if photographed, were caught and frozen in the process of performing special hand gestures construed as cheironomic instructions. From these, he built up hypothetical reconstructions of Ancient Egyptian scales and other patterns[2]. His conclusions have been widely contested mainly because artists had to fit musical scenes within frames delineated by registers, hieroglyphic calligraphy and cartouches, on tomb paintings and in respect of Ancient Egyptian conventions, and that this proved, conclusively, that the scaling was disputable.

Furthermore, the archaeology has not produced any fragments of strings and therefore we do not know what was their section, their tension or their mass.

This paper will examine hand positions of musicians from a new perspective and discuss the following: 1 - Can the position of hands hold clues about interpretation?

2 - Are hand positions different before and after the Hyksos period?

3 - What additional information can we derive from hand positions?

Academic research on hand positions depends on the choice of instruments having been in constant usage for a given time. The harp was chosen since it is seen in various forms and in all periods of Ancient Egyptian history. With regard aerophones, hand positions of flute-pipes and reed-pipes players were also examined.

The voice being the most wide-spread form of music in the Orient, hand positions of vocal cheironimists were also observed.

Before addressing these questions, the purpose of music in Ancient Egypt needs be briefly addressed.

During the Old Kingdom, musical scenes were prominent in daily popular life depicting cheironomist singers and instrumentalists. Preferred instruments were reed-pipes, nay-type flute-pipes and harps. Tomb owners often requested murals with musical scenes. Groups were usually composed of three musicians but there were also ensembles with as many as twelve.

This research rests mainly on the many musical depictions on tomb murals from Saqqara and from Giza. Over sixty scenes have been recorded to this day.[3]

For their trip to their after-life, tomb owners would have not only chosen the wall but also the register on which the scenes would be painted. Regretably, tombs at Giza have been vandalised at least twice as much than at Saqqara and it is therefore difficult to compare them scientifically.

Van Walsem writes that both at Giza and Saqqara the walls to the South were favoured for depiction of musical scenes. Those facing West were less popular probably because this orientation was related to death where music and dance was less likely to appear. During the Old Kingdom, tomb owners predominantly chose lower registers and both in Giza and Saqqara, musicians were placed close to the owners, usually on the lower register near their feet, and sometimes just in front of their legs or under their feet. The same pattern is followed during the New Kingdom. Some murals show musicians playing at food rituals, banquets and funeral processions or scenes, but also during harvest festivals. (fig.1) Tomb owners not only selected music scenes for their pleasure during after life but also because music had special ritualistic powers.

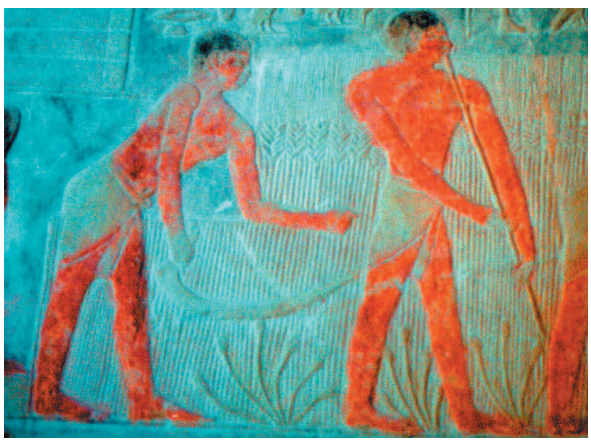

Figure 1. Flute player in Ti's tomb, Saqqara. Author's photograph.

During the Old Kingdom aerophones were mostly played by males. There is one scene where the female harpist Hekenu accompanies Iti, a cheironomist singer.

There were more female musicians during the Middle Kingdom. However, musical scenes in tombs become rarer to the point that they might have disappeared altogether. This of course does not mean that music disappeared from daily life, but would simply indicate that mural tomb depictions with music scenes ran out of fashion and therefore owners would no longer have used them as much as they did during the Old Kingdom. Cheironomists become scarce but this does not necessarily prove that they disappeared.

During the Middle Kingdom, life followed its course more or less as it had during the Old Kingdom and hand positions are similar.

The Egyptian Museum in Cairo has a collection of flutes dating from the Middle and New Kingdoms and from the Coptic period but none from the Old Kingdom have been found to this day. Harps, on the other hand, were found at all times.

Situated in the North East of the Nile delta, Avaris became the capital city of the Hyksos kings during the Second Intermediate Period.

Figure 2. Group of musicians with a blind harpist in the tomb chapel of Paätenemheb. Saqqara 18th Dynasty. Photograph from the Rijksmuseum van Oudheden (RMO), Leiden.

They introduced new musical instruments but Bedouins might also have contributed to this addition. There is evidence that these new instruments became fashionable and in turn were depicted along with lyres and various new types of drums. The nay flute-pipe remained almost unchanged but the single reed-pipe was gradually replaced by the double type or aulos, and with many different percussions including drums and tambourines.

Much archaeological evidence reveals that musical life was intense during the New Kingdom. However, music scenes are often more religious than secular. These scenes consisted of small groups of musicians who were both instrumental and vocal soloists playing mostly in temples. Blind harpists and their songs were of importance during funerals; small groups played during military processions or for religious ceremonies as well as during royal banqueting scenes. (fig.2)

Whether hand positions were similar at different periods in Ancient Egypt may be better elucidated if described as they appear with each instrument.

Cheironomists

Old Kingdom murals show singers with instrumentalists. Singers might be giving cheironomic instructions of interpretation to instrumentalists, or both. (fig.3)

Earlier we mentioned that Hickmann compared the gestures of cantors to gestures of cheironomists.[4] However, as will be seen, only few murals lend themselves to comparative analysis and therefore Hickmann's hypothesis raises questions especially because cheironomy disappears from the iconography just after the Old and during the Middle Kingdom. It is puzzling to see it reappearing at the Coptic period.

Some contemporary Coptic clerics are of the opinion that the gestures of their cantors are the replication of the Old Kingdom cheironomic practice. Hickmann noted this similarity, especially with Mikhail Girgis al-Batanouni (1873-1957).[5] Al-Batanouni was the first Coptic cantor to be recorded and for that reason is known as 'Father of Coptic Hymns'. Hickmann recorded his gestures and compared them to cheironomists.

Cantors today have their own teaching methods for the monodic performance of their choirs and thus it is no longer possible to compare their gestures with ancient cheironomists.

A student of cantor Mikhail al Batanouni, the famous cantor Tawfiq Youssef Bishay al Nakhili (fig.4) conducted his choir with a thick staff which he held with both hands. He was of the opinion that rhythm was more important than melody. He explained to me that choristers memorised hymns in their own time making cheironomic, or other gestures during official rituals redundant. Cantor Nagy Moussa used a different method. His right hand index finger pointing at fingers of the left hand to locate pitches. The thumb was the lowest pitch, the auricular the highest. This system proved adequate but only for his own students.

Cantor Ayad Naguib Ayad (fig.5) indicates the accents of a hymn with his hands. He told me during an interview that his father, who had studied with Mikhail al Batanouni, used the same method.

Cantor Ibrahim Ayad used his thumb for the highest pitch as seen on figure 6.

It could be construed that each cheironomist of the Old Kingdom had, his own method too.

Figure 3. Flutist and cheironomist, tomb of Nn-Kheft-Ka, Saqqara at the Egyptian Museum, Cairo. Author's photograph.

Figure 4. Cantor Tawfiq Youssef Bishay al Nakhili. Author's photograph. al-Muharraq, 2001.

Figure 5. Cantor Ayad Nagib Ayad.
Author's photograph, 1998. al-Qussiya.

Figure 6. Cantor Ibrahim Ayyad.
Author's photograph. Cairo, 1998.

Reed-pipes

The small reed-pipe of the Old Kingdom is often wrongly labelled a clarinet. This is inappropriate since we cannot tell if it had a single or a double reed. To this day, no reeds have been found. This small reed-pipe instrument appears frequently during the Old Kingdom and then vanishes from the dawn of the New Kingdom after the Hyksos period. It is replaced by a double-pipe type, not unlike an early aulos, but we cannot say if it was fitted with single or double reeds. Both instruments are played frontally with fingers rounded around the body of the pipe, giving an impression of virtuosity. On a modern instrument, the fingers would be laying flat on the keys or on the holes.

Examples of finger position on Ancient Egyptian reed-pipes can be observed from the following murals:

Merseyankh III:[6]

There is a reed-pipe player painted on the North wall of the tomb of Mersyankh III. The drawing is not very clear. The fingers of the hand are not visible and the hand position cannot be estimated.

Nen-Kheft-Ka:[7]

The double-pipes player in the tomb of Nen-Kheft-Ka shows powerful fingers. The right hand uses three fingers, the left hand might show that the thumb was used which would not be very comfortable. The player holds the instrument between the middle finger and the fourth finger. There are no holes visible in the instrument.

Figure 7. Tomb Nn-Kheft-Ka, Clarinet player.
Saqqara, Egyptian Museum, Cairo. Author's photograph.

Nefer and Ka-Hay:[8]

In the tomb of Nefer and Ka-Hay the musician is drawn in the course of performance. The drawing is detailed and represents what might be the customary posture used for playing a reed-pipe. Apparently three fingers for each hand are used for playing while the remaining two hold the instrument. The right hand holds the instrument between the middle and forefingers.

Flute-pipes

The Egyptian Museum in Cairo displays several flute-pipes. Some years ago Fathi Saleh and the Egyptian flautist Mahmoud Effat researched these flutes and played some of them[9]. These old flutes give us much information about their playing in the Antiquity. The nay is the only instrument of the antiquity whose shape and construction has not changed much to this day. However, only few instruments from the antiquity have been preserved. This makes it difficult to make any reliable statistical analyses about scales and interpretation of the music of Ancient Egypt. If the morphology of flutes did not change much, on the other hand, materials seem to have, after the Hyksos period. As Keimer pointed out the *arundo donax*,[10] also known as the 'giant cane' a type of reed which was introduced to Egypt from the New Kingdom, had been used for flute-pipe making. Keimer assumed that canes used in earlier periods were phragmites, also known as the 'common reed'. Today, nays are made from Nile bamboo, a cane similar to the *arundo donax* of the New Kingdom.

Flute-pipes displayed at the Egyptian Museum have three or four holes. These are never depicted in the iconography. A three-holed flute-pipe can be played with one hand, the second holding it. However, three finger holes deliver only simple melodies.

Old Egyptian drawings show flute-pipes of various lengths. The longest model at the Cairo Museum is about ninety centimetres and dates from the Old Kingdom. Mahmoud Effat found that several flutes of the museum had F as their lowest pitch and a span to suit a male voice. Long flute-pipes rested on the ground[11] as seen in tombal iconography.

Figure 8. Nay player Anne van Oostrum plays on a modern Nay- flute made from Nile bamboo. Author's photograph.

Selected examples of hand positions:

Akhethetep:[12]

The flautist in the tomb of Akhethetep is sitting in a playing position.

His flute-pipe is held in position with his right-hand auricular finger. Other fingers are used for playing. No finger holes are visible on the drawing but the cane nodes are.

Mersyankh III:[13]

The reed-pipe player on this mural has been described earlier in this paper. The iconography only reveals the flautists's hands with the left slightly over the right one. The illustration does not show either finger hole or node.

Nefrirtenef:[14]

The mural of Nefr ir.tenf shows both idle hands under the flute-pipe.

Figure 9. Hetep-her- Akhti (OK) flautist.
Photograph by the RMO, Leiden.

Nb-Kaw-Her:[15]

In the tomb of Neb-Kaw-her three fingers are placed on the flute-pipe, the left hand secures it. Nefr ir.tenf and Nb-Kaw-Her are two examples of long flute-pipes resting on the ground.

Hetep-her-Akhti: (fig.9)

Figure nine shows a flute-pipe player in a position similar to the previous one. The rim of the end part of the flute-pipe rests on the ground. The position of the fingers is different with the thumb of the left hand securing the instrument.

Nine fingers are distinguishable on the instrument. There are neither holes nor nodes to be seen.

It is surprising that only few drawings of pipe-flutes show detailled hand and finger positions in a manner that would have been customary to Ancient Egyptian musicians's playing techniques.

Most drawings show the whole hand on the pipe in a relaxed position. A walking shepherd in the tomb of Ti also plays in this manner[16]. This might have been dictated by some ritualistic or symbolic reason as it is of course not possible to play in this manner.

Regarding the flautist depicted in the tomb of Paätenemheb (fig.11), his hand is placed under the instrument in order to secure it. The left hand is relaxed and is placed at the end of the pipe, also securing it.

However, some illustrations show flautists playing with only one hand, the second securing it. This would seem to be a more realistic depiction as it is possible to play up to two octaves with only three holes, as exemplified by the models at the Museum of Cairo.

Harps

Because of its frequent representation, the harp might also have been a favourite in Ancient Egypt, at all periods. There are almost no scenes without it. During the New Kingdom two distinct types were played with similar hand positions. There are also instances where the position of hands are inconsistent with practice and are found at different periods. There would also have been drawing conventions dictated for some unexplained reason, probably ritualistic or symbolic, but which were certainly not realistic playing positions.

Follows some illustrative examples:

Nikau-Ra: Old Kingdom[17]

This tomb was already mentioned in the introduction. There are two female musicians, one Hekenu, the harpist, with Iti, her cheironomist. The strings of the harp are not drawn. The fingers are in an appropriate playing posture.

Wer-iri-n-ptah: Old Kingdom[18]

Both hands and all fingers are visible. However they are not drawn playing the harp and float in mid-air.

Antefoker: Middle Kingdom[19]

In the depicted posture, only two notes could be played. We do not know if this illustrated either simultaneity or or consecutiveness, illustrating either melody or harmony.

Sa-Isis: MK[20] (fig.10)

The harp player on this stele has both his hands before the strings plan of the instrument. Again this posture might indicate drawing conventions dictated for symbolic or ritualistic purposes.

Rekhmire: (NK, Private tomb, Toutmosis III period. (1479-1425).[21]

The hand position of the harpist in this tomb ressembles that of a pianist. The right hand plays only with the thumb.

Figure 10. Stèle of Sa-Isis.
Harp player is under the feet of the owner of the stele.

Paätenemheb: (NK, RMO Leiden)[22] (fig.11)

The blind harpists hands are placed away from the string plan. All fingers are seen. The left hand position is satisfactory but the position of the right hand is not practical.

Djedkhonsouioufankh: (NK, 21st-22nd Dynasty)[23]

This harpist is depicted in a realistic playing posture. The right hand is behind de strings and seems to play just one note. The left hand is on the strings in a playing position, all five fingers active.

Figure 11. Paätenemheb.
Showing the hand position of the harp player.

Figure 12. Paätenemheb.
Showing the hand position of the flute player.

In order to study posture and hand/finger position, I have seeked advice from Nine Kwint, a professional harpist, to replicate some of the positions from drawings. This experiment gave unexpected result.

The elegant and beautiful hand positions in the tomb of Mereruka[24] (fig.14) are graphically aesthetic but musically unproductive.

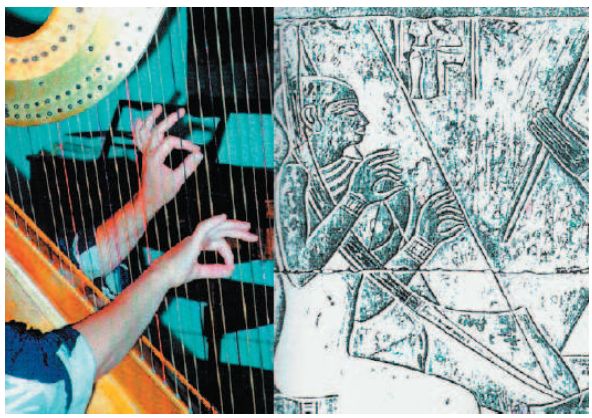

Figure 13. Imitation of playing position. Mereruka.

Figure 14. The mastaba of Mereruka. part II, Pl. 94

The two harpists in Qar and Idu have appropriate playing postures. One hand plays, the other dampering the strings. (figs.15-16)

Figure 15. Dampering the strings.

Figure 16. Qar and Idu. Pl. XXIVb. Dampering strings.

The harpist in the tomb of Akhet-Hotep (fig.18) shows a practical posture. One of Akhet–Hotep's hands is behind the strings as it should be. The right hand plays on the front side of the instrument, and is shown away from the strings.

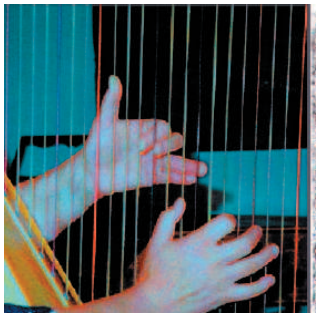

Figure 17. Imitation of Akhet –Hotep.

Figure 18. Akhet-Hotep.[26] After Hickmann.

Nen-kheft-ka (fig.20) is drawn showing a good posture as it was also with the reed-pipe player in the same tomb. The artists must have appreciated music as the harpists's hands are drawn in a very realistic manner.

Figure 19. Imitation of Nn-Kheft-Ka.

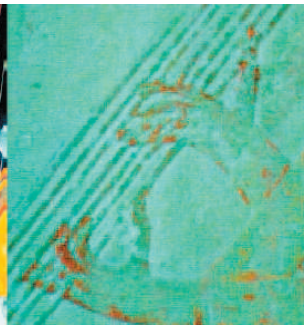

Figure 20. Nn-Kheft-Ka. Egyptian Museum, Cairo.

Conclusion:

Only few tombs with musical scenes, pre and post Hyksos give insights on playing techniques.

In most cases hands and fingers have been depicted without much detail, probably because it was difficult for the artists to capture playing movement satisfactorily and therefore their elusiveness in this respect was better suited to illustrate movement in music interpretation. However, this does not help much in the appreciation of possible aspects of theory. But generally the instrument itself was probably more suggestive to the average Ancient Egyptian, rather than the posture of musicians and would explain the very approximative depiction.

Flute-pipes, having a smooth timbre would have flautists playing with relaxed hand and finger positions perhaps to illustrate the quality of the sound. In contrast, the more penetrating timbre of reed-pipes might have been illustrated by an impression of active playing musicians.

The elegance of the harp would have encouraged the artist in depicting graceful gestures of virtuosity. The artist would have equated his fluency to the pleasing of the sound of the noble instrument. The fluidity of the harp would have encouraged the depiction of finger agility, showing as much of it as possible.

It is fascinating to look to the Old Egyptian music scenes, but one cannot be sure that the tomb owners could have heard any pleasant music flowing out of these hand positions.

Notes

1 Hans Robert Hermann Hickmann (b. Roßlau, Germany, May 19, 1908; d. Blandford Forum, England, September 4, 1968) was an eminent German musicologist. He lived in Egypt and specialized in the music and organology of Ancient Egypt, and survivals thereof in Egyptian traditional music. He wrote about Egypt's tradition of cheironomy (as practiced in Ancient Egypt and still found in Coptic music) for the Grove Dictionary of Music and Musicians. He studied at the University of Berlin, studying with Curt Sachs and Erich von Hornbostel, and graduating in 1934. He also played the piano and organ, and conducted. Hickmann first investigated Egyptian music in 1932-33, during a visit to the Siwa Oasis, and settled in Egypt in 1933. He operated a conservatory called Musica Viva, located at 1 Seket el Fadl in downtown Cairo. (http://en.wikipedia.org/wiki/Hans_Hickmann)

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SUMMON THE GODS AND THE PEOPLE TO THE SOUND OF THE CONCH*

Elynn Gorris and Wim Verhulst

Introduction

Recent excavations at the site of Tell Tweini, in North West Syria, have revealed various triton shells excavated in the vicinity of an Iron Age temple complex dated around 800 B.C. The apex of two of the shells had been removed suggesting that they were used as trumpets. The triton shell is known from prehistory not only in the Mediterranean, but in the Pacific as well as the Atlantic.[1] World-wide cultures have used and still use them for sound production. The discovery of the Tell Tweini conches prompted a research for its usage in the Levant and the East Mediterranean region, especially during the Bronze and Iron Ages. The use of the conch as a trumpet in religious and cultic context has been attested in many archaeological sites of the East Mediterranean. This paper will comment on experiments made on pitch, volume and range, to demonstrate that the conch could have been used for communication in the Levant.

* We are grateful to Guy Putzeys of dBA-Plan for his help with tests. This article was made possible thanks to the architectural and archaeobiological research staff of the Tell Tweini Excavation Team, led by Joachim Bretschneider. Our thanks are extended to Saskia Willaert of the Musical Instruments Museum (Brussels), the Onderzoeksfonds K.U. Leuven and the Research Foundation Flanders.

The conch as a musical instrument

The triton shell is named after the Greek God Triton, messenger of the sea, son of Poseidon and Amphitrite. He was also known as Neptune's trumpeter in the Roman tradition. The god Triton is mostly depicted as a fish-tailed merman holding a conch trumpet. He ruled the sea blowing his conch and the iconography of this depiction is attested all over the Mediterranean during the Classical and Hellenistic periods. In Sicily, two 5th century B.C. Greek bronze coins were unearthed. They are stamped with a young man riding a goat while blowing a conch.[2]

Triton shells are the calcareous outer protective covering of invertebrate animals belonging to the phylum *Mollusca*.[3] For archeologists, the two most important classes in the phylum *Mollusca* are the gastropods, such as the triton shell and the bivalvia such as clams, oysters and mussels. In the Mediterranean two types of triton shells are used as trumpets: 1) the *charonia sequenza* and 2) the *charonia nodifera*.[4] The *charonia sequenza* has a smooth body, while the *charonia nodifera* has knobs all over. Both types of shells measure up to 30cm in length. In order to make instruments of them, the apex needs to be cut off. In some cases the conch had an additional hole to modify the pitch.[5] Other names, describing the same instrument are 'conch shell',[6] 'shell trumpet',[7] 'triton's trumpet'[8] and 'triton horn'.[9] In this paper we shall use the mythological name of 'triton shell' for the object itself. When discussing the shell, as a musical instrument, we will use Braun's term of 'conch trumpet',[10] the name being closely linked to the classification in Hornbostel and Sachs. In this classification, conch trumpets found in the Eastern Mediterranean are aerophones, since sound is generated from vibrating air, and therefore belongs to the 'trumpets', (category 423): where the player's vibrating lips set the air in motion, particularly for 'end-blown conch without mouth-piece' (category 423.111.2).[11]

Conch trumpets have a conical bore or conical bores. The bore of a tube affects harmonics and has a direct influence on the timbre of an instrument. In a conical tube the air moves in a triangular

waveform, while in a cylindrical tube, the air moves in a square waveform. As a result conical instruments sound warm, and cylindrical, sharper.

Tell Tweini Conch Trumpets

Figure1. Map Northern Levant.

Tell Tweini, the ancient Gibala, is located on the Syrian coast at about 40km south of Ugarit and about 50km north of the Phoenician town of Arwad. It is surrounded by two rivers, the Rumailiah and the al-Fawar. In antiquity these rivers provided the town with access to the Mediterranean Sea.[12] During the late Iron Age large parts of the rivers had silted up. They provided an excellent conservation environment for triton shells: the soil is rich in calcium and poor in acid.[13] Therefore most triton shells in the Levant were found in archaeological sites close to coastal areas of the Philistine and Phoenician cultures.[14]

It is most likely that Tell Tweini was founded at the end of the Early Bronze Age.[15] During the Late Bronze Age Gibala was the southernmost harbour of the Ugaritic kingdom and exported goods from the Syrian hinterland to Cyprus. After the collapse of the Ugaritic Kingdom, the population of Gibala succeded in rebuilding their town and increased their share in the international trade, under Phoenician control. Attracted by the wealth of Phoenician states, Neo-Assyrian kings conducted campaigns against these East Mediterranean states and Tell Tweini was incorporated to the Neo-Assyrian Empire.[16] The Tell Tweini conch trumpets date from around the Neo-Assyrian conquest.

During the archaeological campaigns of 2001 and 2005 two *charonia sequenzae* with their apex removed were excavated in the early Iron Age layers, at the centre of Tell Tweini. During the Iron Age this area was mainly occupied by public buildings, storage rooms and workshops. The public space was located between the west street and the central street.

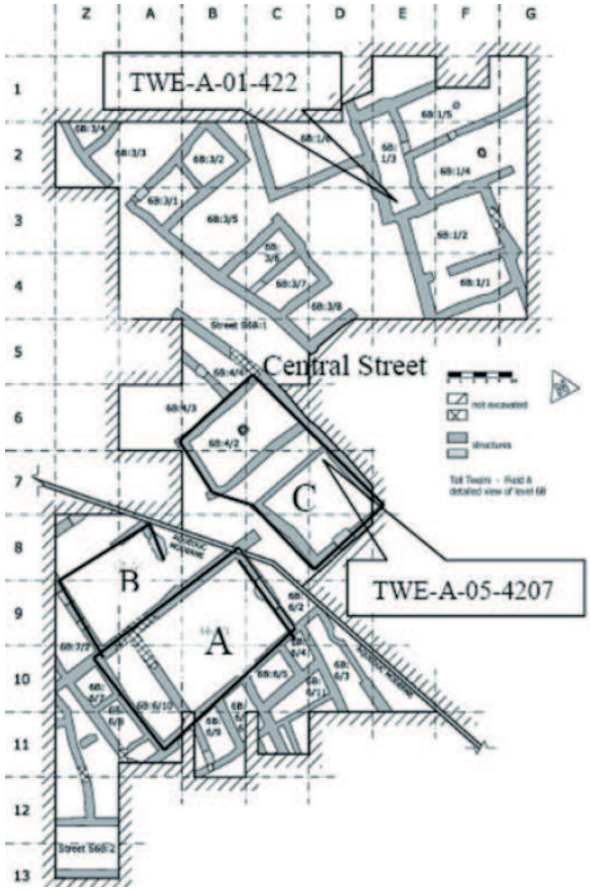

Figure 2. Location Tell Tweini conch trumpets in field A

The first conch trumpet (TWE-A-05-4207) is 19cm long, with the first two windings removed, and has an opening at the apex of about 3cm. The trumpet was found near one of the outer walls of public building C in the Iron Age II layer. At the east of this wall ran the central street. The entrance of the building was located south and had a monumental door-socket. West of building C a smaller street provided access to two other large buildings. Building A was constructed of a Langraum fronted by an entrance-hall with a paved floor. In building B, parallel to building A, only the Langraum was uncovered.

Both buildings are fronted with open courts the entrances of which having the same monumental door-sockets as in building C. It is likely that buildings A and B were initially constructed as twin temples.[17] Comparable buildings were found in Kition (Cyprus) and Tell Kazel (Syria) and interpreted as sanctuaries. The connection of building C with the other buildings is not clear yet, but the size of building C suggests public function. Had the public building been a temple of some kind, the conch trumpet might have been used to invoke the Gods. Had building C been used for profane matters, the conch trumpet would have been used to gather people for public announcements. In both cases, the conch trumpet would have fulfilled an important task in the daily life of Tell Tweini and was undoubtedly played by musicians with a social status which needs to be defined.

The second conch trumpet (TWE-A-01-422) was excavated in the more residential part of the centre east of the central street and measures about 16cm long with a 2,5cm opening at its apex. The first two windings had also been removed purposely. This shell was found on an Iron Age II floor in the south-western corner of a room, along with a large amount of local ceramics. The absence of public buildings in this part of the centre suggests a more domestic usage of the conch trumpet. In this area an Iron Age II grave was discovered. It may be that the conch trumpet was an accessory to a domestic shrine.

Conch Trumpets in the Eastern Mediterranean

The primary sources of information for the musical tradition of the conch trumpet in the East Mediterranean are archaeological findings and iconographical material. To improve our understanding of the Tell Tweini conch trumpets, we shall investigate the various contexts in which conch trumpets are found in the archaeology of Crete, Cyprus and in the Levant.

As early as the third millennium B.C., the Minoans used the conch trumpet to invoke their gods. The earliest iconographical illustration of it is a stamp seal (1850-1550 B.C.) found in a Zeus cave sanctuary on Mount Ida, in Crete. This seal, carved out of stone, shows a priestess blowing a conch trumpet in front of what might have been an altar or a bench sanctuary.[18] Conch trumpets found in Crete have been also excavated in graves, bench sanctuaries, cave sanctuaries, palace temples as well as in domestic shrines. The importance of the conch trumpet in Crete increased during the proto and neo-palatial period, (1850-1452 B.C.) when the Minoans manufactured triton baked terracotta shells, found at Mallia, and Pyrgos, and carved them out of stone.[19] In the Upper West Court Sanctuary of Phaistos, (1800-1700 B.C.) a conch trumpet was unearthed in the temple room together with offering tables. It was found near a wall in the southern corner of a bench sanctuary inside the Minoan palace.[20] At Knossos a *charonia sequenza* with an adapted apex was excavated in the Late Minoan Glypsades Hill House Shrine, dating from about the 15th century B.C. The conch trumpet was found near the libation table of a domestic shrine.[21] At Kephala Khondrou, a conch trumpet also appears in a domestic area.[22] On the upper floor shrine of a late Minoan house dated to about 1400-1200 B.C., a *charonia nodifera* with an adapted apex was found along with ritual objects. The conch trumpet was found east of the stairs in room N1. All Cretan conch trumpets were recovered from sanctuaries, with no clues as to their usage in public or private context. The archaeological context of these conch trumpets confirms the depiction on the stamp seal of the Idaean cave.

In Cyprus, most of the excavated triton shells have a fully preserved apex and were therefore used as vessels or as containers.[23] However, in some of them the apex was missing. It is possible that they would have been used as conch trumpets. The tradition of using the conch trumpet in cultic contexts in Cyprus is not attested before the end of the Late Bronze Age. At Hale Sultan Tekke, in Cyprus, a conch trumpet was found lying on the floor in the north-west corner of a large building of the Late Bronze Age.[24] Together with the conch trumpet, the excavators found juglets, two grinders, a pestle close to a well. This collection of finds suggests that the large building might have had a religious function. Another conch trumpet, 21cm long, and dating from about 1050 B.C. was unearthed at the Kition sanctuary.[25] It was found in a well of a workshop in room 12 which was connected to the temple building. The blowing-hole,

measuring 2.3cm in diameter, was carefully smoothed for a comfortable feel on the lips. In the Levant, nine conch trumpets,[26] dated between the Late Bronze Age and the Hellenistic Period were uncovered in towns within the Phoenician and Philistine vicinity. The earliest attested conch trumpets[27] in the Philistine region came from a sanctuary in the coastal Late Bronze Age harbour-town of Tell Nami. In the Philistine town of Tell Qasile, about 1100-1050 B.C., a *charonia sequenza* 19,5cm long, with an adapted apex was found among cultual objects of the temple.[28]

The conch trumpet used as cult instrument probably originates in the Minoan civilization and would have extended eastwards to the Cypriot and Levantine cultures. According to Aström and Dietrich[29] conch trumpets found in the eastern part of the Mediterranean came from sanctuaries, temples and graves, and date from after the movement of the Sea People at the beginning of the 12th century B.C.

Generally, musical instruments have been found in palaces, local centres of power, close to city walls or fortified towers. Idiophonic instruments such as conch trumpets were used for communication purposes and would have warned of danger; announced the arrival of people, or visitors or of other events during the day, or the night. In this context a large fragment of a conch trumpet 14cm long was unearthed in the courtyard (stratum XII/locus 275) of Tell Qasile.[30] A rather special conch trumpet was excavated inside the Iron Age Casemate wall of Hazor,[31] about 45km from the Mediterranean Sea. The Hazor conch trumpet dates from the end of the 9th century B.C. and measures 25cm long. It has a small hole of about 3mm drilled throught it on one side. Most conch trumpets of which the pitch was analysed, produce only one tone within the first octave, except for the one of Hazor where a small hole close to the mouth piece served as a finger hole to change the pitch. Two tones e' and e' flat were recorded on this model.[32]

The conch trumpet as a communication means

The conch trumpet is used mostly as a cultic instrument. But are the acoustical characteritics of the conch-trumpet sufficient to satisfy its categorisation as a signaling instrument?

Although the Hazor exemplar gives an idea about pitch, the volume and sound range of conch trumpets have never been tested. If they were used as signal or communication devices, the sound would have needed to be carried over an appropriate distance. Two tests recently conducted with the Tell Tweini conches gave interesting results.

During the campaign of 2010 we ran a first sound range basic test at Tell Tweini. We used the conch trumpet (TWE-A-05-4207) that was found inside building C. This triton shell was the largest and best preserved from Tell Tweini.

Figure 3. Tell Tweini conch-trumpet. (TWE-A-05-4207)

The conch trumpet was blown from the roof of the excavation house at 2.50 m above ground level. The house is located at the south of the tell, close to ancient city wall. Team members spread from the tell, to the north, the south and the west, to check how far away it was heard and marked their last location on the geophysical map of Tell Tweini.

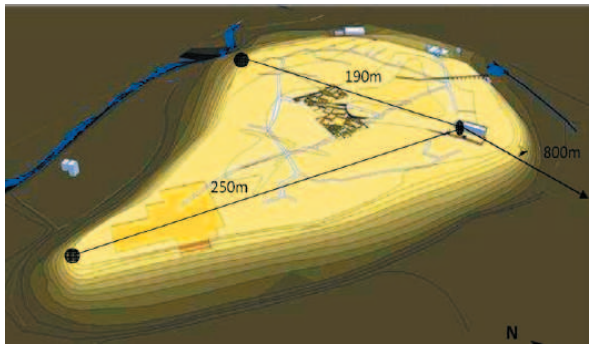

Figure 4. Tell Tweini sound test.

To the west, they needed to go through the Syrian excavation field B, about 250m from the excavation house. The signal was quite weak at the farthest west edge due to the noise a farmer working his land. The sound waves of the conch trumpet had to fight a head wind because on that day – and as with most days during the Spring season – the wind blew from the Mediterranean Sea towards the mainland, eastwards. At the northern side the signal of the conch trumpet could be heard about 190m away, but the steep edge across the A-field prevented them to go further down. To the south the sound waves were carried by back wind and the signal was good and clear up to around 800m, although the sound was at times poluted with environmental noise.

Encouraged by the results of the first basic test in Tell Tweini, the excavation team decided to conduct a second test, this time in Belgium, with better acoustic conditions. Sound expert Guy Putzeys from 'dBA Plan-Noise & Vibrations' was invited along. The purpose of the experiment was to retrieve appropriate figures for sound emission spectra, distance and range.

Figure 5. Tell Tweini conch trumpet. (TWE-A-01-422)

The second Tell Tweini conch trumpet (TWE-A-01-422) is kept in the National Institute of Natural Sciences in Brussels. This triton shell is smaller than the other one. (TWE-A-05-4207) The apex is slightly damaged. The pitch recorded for this is a g'. It has a small hole at the end of the shell. However, we assume that the hole was not made intentionally, on account of its irregular shape. During the test the conch trumpet was played hole closed. When the hole is left open it sounds a semitone higher.

On October 31st 2010, we undertook a test to analyze the sound emission and the sound level at the Mechelse Heide, Maasmechelen in Belgium, a nature reserve in an open space with no buildings, sandy soil or heathland, and a low level of background noise, not more than 35 dB(A). Humidity was at 70%, and temperature was 15°C, about the same conditions as in Tell Tweini. The sound level was measured at different distances: 1, 25, 50, 100m, and then every 100m until 1500 and 1550m. Sound consists of mechanical wave which require air as a transport medium. The longer the distance between two points, the weaker the signal. There is a loss of energy due to the distance, air and soil absorption.

For example, sandy soil, such as in Tell Tweini and the Mechelse Heide, absorbs sound more than water. The audio range for human beings is measured between 20Hz and 20,000Hz. Speech communication is between 250Hz and 4000Hz.

The sound of the conch trumpet gave a reading of 118dB(A). At a distance of 1m we read 107dB(A). The frequency spectrum analysis (See Table 1: Frequency Spectrum) gave 400 Hz and 800 Hz frequencies as being the strongest; 800 Hz is the first harmonic of 400 Hz. The 400 Hz tone frequency is not absorbed by the air, at least for a distance up to two kilometres, and therefore crucial for sound transmission on open air. At a distance of 100m, 400Hz gave a reading of 67,4 dB(A); at 900m the reading was 51,6dB(A) and at 1550m away from the emission point, it was 45dB(A). We allowed for an error margin of 5dB(A). (See Table 2: Measure points).

In order to make an estimation of sound levels at greater distances, a calculation was made in accordance with ISO 9613 Standards. They provide with the method taking in account various parameters such as the atmospheric sound absorbtion to determine levels under varying conditions. This showed that at a distance of 2300m, the sound was still perceptible with a level of 35dB(A), with a low background noise of 30dB(A).

When the data were copied to a map of Tell Tweini and the surrounding area of Jebleh, it became clear that a trumpeter sounding one conch trumpet could be heard at the coastline, which is only 1700m from Tell Tweini. For a stronger signal, the

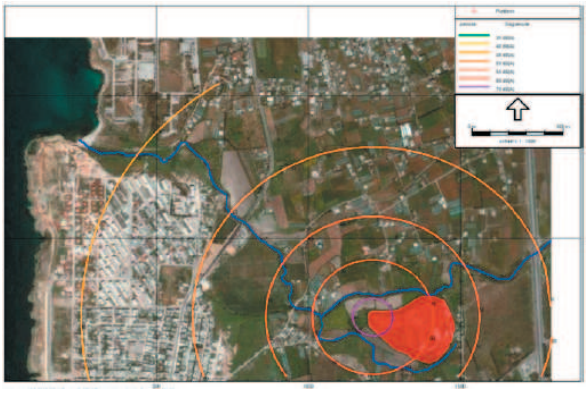

Figure 6. Sound distance of the conch trumpet.

people of Tell Tweini could have used more conch trumpets. Three conch trumpets sounded together produce an increase of 5dB(A) on a distance of 2300m. At a distance of 3000m, they would produce 35dB(A). Was it possible to use these conch trumpets to communicate between tells? While in theory this would have been possible, in practice, about 40 conches would have been needed to bridge a distance of about 6.5km to reach the next settlement of Tell Sukas.

Conclusions

The religious and cultic context of the Tell Tweini conch trumpets is not as obvious as in the Upper West Court Sanctuary in Phaistos, in Crete, for example, but some archaeological contexts in the East Mediterranean are comparable to Tell Tweini. The first conch trumpet (TWE-A-05-4207) was unearthed in a public building similar to the Hale Sultan Tekke exemplar and the one in the Tell Qasile courtyard. The second conch trumpet (TWE-A-01-422) can be compared to the Glypsades Hill House Shrine and the domestic shrine at Kephala Khondrou.

Sound tests confirm that the Tell Tweini conch trumpets have the acoustical qualities for signal/communication purposes. Sound signals from them could he heard from the harbour, the city and its hinterland. They summoned gods as well as the people.

Notes

1 The pitch is still unknown: we lacked a tuning fork at the time of the finding of the instrument, which is currently kept in Syria.

2 SNG ANS Himera: 170-4, 184-5.

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11 Hornbostel E.M., von, and Sachs, C., Classification of Musical Instruments, *The Galpin Society Journal* 14, 1961: 27.

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14 Braun 2002: 181.

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17 Bretschneider–Van Lerberghe 2008: 44.

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29 Aström 1990: 6; Dietrich 2009: 39-40.

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Table 1. Frequency spectrum.

FREQUENTIESPECTRUM IN 1/3 - OCTAAFBANDEN

Opdrachtgever : KULeuven
Meetdatum : 31-Oct-2010
Meetplaats : Mechelse Heide

BAPlan noise & vibration

1m distance from triton shell

Freq (Hz)	1/3 band lineair	1/1band lineair	1/3 band A-weging	1/1 band A weging
25	72,0		27,3	
31,5	69,5	75,1	30,1	36,3
40	69,0		34,4	
50	67,5		37,3	
63	61,5	69,1	35,3	41,6
80	60,0		37,5	
100	64,0		44,9	
125	72,0	76,4	55,9	62,0
160	74,0		60,6	
200	70,0		59,1	
250	73,5	82,8	64,9	75,9
315	82,0		75,4	
400	111,5		106,7	
500	83,5	111,5	80,3	106,7
630	83,5		81,6	
800	100,0		96,2	
1000	77,5	100,1	77,5	99,4
1250	84,5		85,1	
1600	85,5		86,5	
2000	70,5	86,0	71,7	87,1
2500	75,5		76,8	
3150	71,5		72,7	
4000	74,0	80,1	75,0	80,8
5000	78,0		78,5	
6300	71,5		71,4	
8000	62,5	72,5	61,4	72,1
10000	62,5		60,0	
12500	63,0		58,7	
16000	64,0	66,9	57,4	61,2
20000	55,5		46,2	
Som	111,8	111,8	107,5	107,5

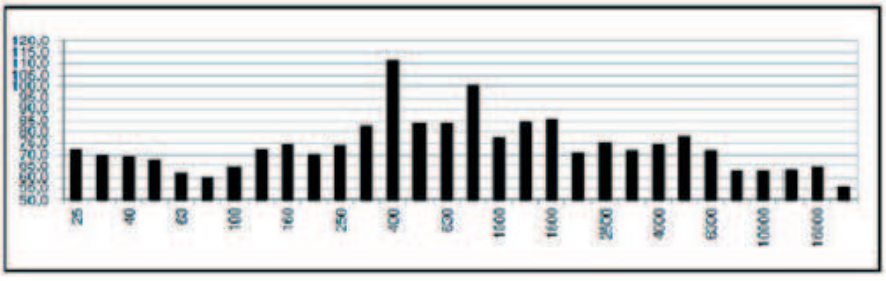
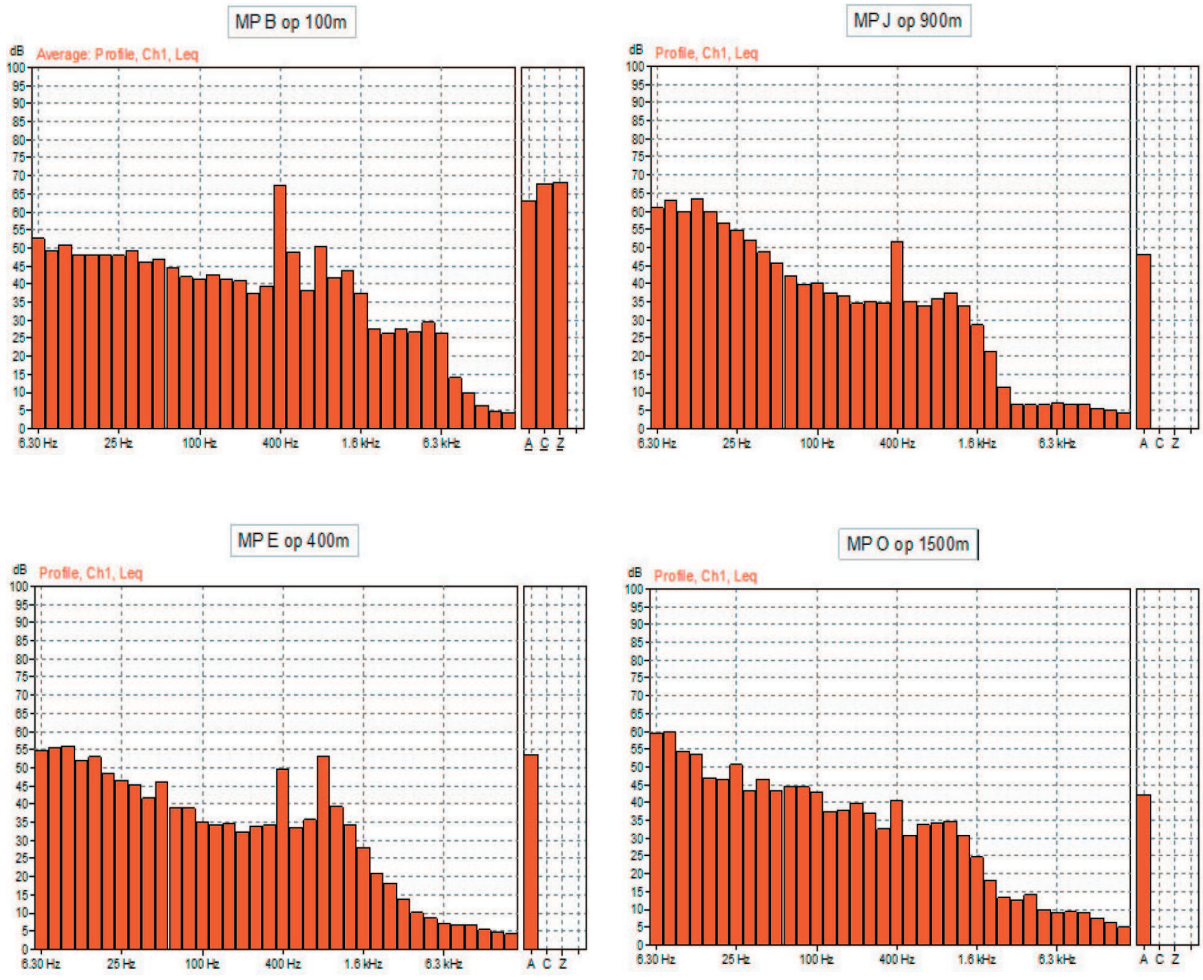


Table 2. Sound level at different distances.



SINGERS, MUSICIANS AND THEIR MOBILITY IN UR III PERIOD CUNEIFORM TEXTS[1]

Regine Pruzsinszky

Musicians have always been travellers. They crossed boundaries, walked or rode to cities where their performance was requested and appreciated. The aim of this paper is to show evidence of mobility in musicianship and exchanges, from cuneiform texts of the 3rd millennium B.C., and more precisely from Ur III Southern Mesopotamian archives.

Previous researches on the music of that period mainly have dealt with musicology and musical instruments.[2] This paper focuses on musicians who played for the entertainment of an audience. The nar or *nāru* was an instrumentalist. However, since school texts focus on his vocal performance, I would tentatively translate Sumerian 'nar' with 'singer'.[3] Highlighting the importance of studying the social context of music and the status of musicians in Ancient Egypt, A. von Lieven wrote:[4] *'After all, the instruments did not play themselves: it is always human beings with a special place in their society who are behind them.'*

Since this paper mainly discusses the activities and mobility of the nar, I will leave aside other types of musicians known from the lexi-cology of Ancient Near Eastern texts. We shall examine the evidence of their journeys from one city to another and attempt identifying its contextuality. The conclusion will propose a definition of the function and mobility of musicians, and will contribute to the clarification of cultural consequences, that is the diffusion of musical practices of these movements and exchanges, at that period. Even if they are not fully explicit, texts stated allow us, nevertheless, to imagine the kind of musical practice which would have been exchanged. The discovery of musical instruments and musical scenes depicted on archaeological finds contributes to the sustainability of our theory on musical exchanges. Contemporary music and instruments from Western Asia are living examples of the various and intermingled traditions which have merged during the course of past centuries.

Royal courts, especially, are known to have been the seats of cultural diversity. In order to display their power and glory in exotic and/or prestigious fashion, kings and their royal household indulged in the company of well educated and talented musicians. Clearly identifiable regional musical styles and distinctive schools of music can be traced within the epistolar corpus found at Mari, roughly dating to the 18th century B.C.[5] The textual evidence from that city reveals a distinct appreciation of exotic musicians. The presence of foreign artists was requested at Mari where they were keen on knowing new repertoire.[6] The king of Mari supported the education of musicians, sending students to other cities to learn new songs from foreign masters. The Mari letters are unequivocal in that a musician wanting to travel to other cities must come back and was only granted travel leave in exchange of a deposit.

The keeness for exotic music becomes most evident with the high demand for Šubarean (Hurrian) and Amorite music, which seems to have been very popular throughout Syria and the Levant. The well-known letter ARM 10, 126 written by Zimri-Lim to Queen Šibtu says that some deported pretty ladies of the palace, originally from the Ḫabur area, and working in the textile industry were to be relocated and instructed in the Šubarean orchestra.[7] This special training would have included a particular music repertoire much valued at the court of Mari, the city of music (*nārūtum*).[8]

Long-distance exchange of musicians is also attested between Mari and the city state Ḫazor, north of the Sea of Galilee.[9] Letter FM III 143 says that Hazorites accompanied by three young Amorite female musicians travelled to Mari. Here, 'Amorite' could either be taken as a geographical term or refer to the musicians' language. Another letter (FM IX 41)

from the king's chief musician at Mari reports that *aštalītum*-musicians who were still being taught the *šebītum*-instrument had been summoned by the ruler of Ḫazor. Because the ruler had strong ties with Egypt, this may well constitute evidence that Ḫazor would have been the bridge for musical exchanges between Egypt and the Ancient Near East.

Court musicians of Mari were involved in the preparation of wedding arrangements between the royal families of Mari and Aleppo. A *nargallum* attended negotiations taking place in Aleppo before the wedding, and was in charge of the festivities. In contrast to practice at the royal courts of Mari, travel protocols from Nuzi (end of second half of the 2nd millennium) do not mention any musicians in their lists of the travelling king's entourage including high-standing officials and functionaries of the Mittanian state.[10]

There are also royal inscriptions of the 1st millennium providing evidence of exchange of musicians as well as of musical traditions. During his 3rd Western campaign, Sennacherib (704-681) subdued Hiskia of Juda additionally to his booty of precious objects, munitions, women courtisans, he wanted male and female singers to be brought to Niniveh.[11] Assurbanipal reports to have deported Elamite singers. They are represented on bas-reliefs at his palace. There is an etching on a funnel shaped silver goblet, of unknown provenance, from the time of Assurbanipal with five groups of musicians with their instruments that E. Bleibtreu appropriately labelled as 'Vielvölkerorchester'.[12] After having besieged Gambulu in Elam, Assurbanipal described his conqueror's return those terms:

'Accompanied by musicians making music (itti nârē ēpiš ningûti) I entered Niniveh.' [13]

Significant evidence for musicians of different backgrounds comes from administrative documents and lists relating to the harems of the court, at all periods. Highly regarded female singers, kept in harems, were an important part of the prestigious inventory of the palace household. Personnel-lists from Mari[14] and Nuzi,[15] in the second millennium as well as the Nimrud Wine Lists[16] from the first millennium, give a glimpse of the rich musical life of female singers and musicians. Each of these groups might have been trained for a specific repertoire, as documented in Hittite texts, where it is said that musicians were taught Hurrian or Hattic songs.[17]

Rulers also loved to boast of their prowess as great musicians and poets, an indispensable complement to their kingship. Arts always have been a tool for a monarch's ostentation of power and glory. Some rulers boasted of their talent as musicians, as known from royal hymns. Šulgi, the 2nd ruler of the 3rd dynasty of Ur, at the end of the 3rd millennium B.C., praises himself in those terms:

'I, Šulgi, king of Urim, have also devoted myself to the art of music. Nothing is too complicated for me; I know the full extent of the tigi *and the* adab, *the perfection of the art of music.' ... 'I am Šulgi, the great musician, superintendent of the art of music. ...'* [18]

As early as the 26th century B.C. there is evidence of musician mobility: WF 70: iv 10-12, a document from Fara, attests to a nar from Uruk attested among visitors from Uruk and Nippur who resided at Šuruppak for a while and received rations of barley. These rare cases of named individuals lead Pomponio and Visicato[19] to the conclusion that these were foreign officials who resided at Šuruppak temporarily and were paid by the administration of the city while working there rather than personnelfrom Šuruppak posted to other Sumerian cities.'.

The wealth of evidence from Ebla dating from the 24th century B.C. spans over a period of about 42 years and consists mainly of administrative texts, documents recording the expenditures of textiles and metals by the palace administration, as shown by Tonietti.[20] The lists of textile expenditures also mention singers traveling with notables and kings, the en-ruler of Ebla, throughout Upper Mesopotamia. They are attested in groups and come across the well known centers of Nagar, Emar, Kiš, Tuttul and Ibal, and sometimes pause for special occasions, such as military campaigns, cultic rituals (*e.g.* the i̯iš-i̯iš ceremony) and festivities including a marriage celebration in Ebla, for instance. The en of Nagar brought along a group of musicians when his son married a daughter of the king of Ebla. Similar occurrences are attested in later sources from Mari, Alalaḫ and Niniveh. The exchange of foreign musicians among the great courts belonged to the diplomatic exchange which played an eminent role in the interplay of political powers. Strong ties existed with Mari situated southwards along the Euphrates.

The exchange of musicians indicates that one obviously valued the musical practices from inner Syria. The nar from Mari, a group of 2-3 senior musicians with 21-25 junior musicians, appear distinctly from the Ebla group of singers, who, for some reasons, are segregated from the Mari group. They have Sumerian names which have been interpreted as stage names. Tonietti (2010:76) assumes that the Mari and Ebla groups had different musical practices.

Apart from groups of singers, we know of individual musicians who were obviously not recruited from the aforementioned groups. These nars were said to have come from city X to Ebla, where they were reimbursed with textiles. Tonietti (2010:79) assumes that those may have been individuals who on specific occasions probably might have introduced 'different performing styles or repertories'.

Additionally, the Sargonic texts from Nippur report on singers from various towns (Marada[21] and Adab[22]), who received land and textiles. Again, Westenholz[23] assumed that these were individuals of high standing since they are mentioned along with ambassadors from other cities. In the Sargonic text from Umma, LATIM 27, a group of nar are reimbursed by uz-ga personnel[24] for their accompaniment of Šarkališarri on his journey to Sumer.[25]

In order to prove that musical exchanges existed during the Ur III period we shall examine the evidence of the musicians' mobility from administrative documentation and hypothesize on purpose. The Ur III period offers abundant materials on singers and musicians: Tens of thousands of documents stem from various centres in Southern Mesopotamia dating to the end of the 3rd millennium B.C. Administrative documents were found in the state archives of Ur and Puzriš-Dagan/Drehem, in the provincial archives of the governors in Umma and Lagaš, as well as in the private and temple archives of Nippur. All of these offer abundant information on nars of different social status over a period of about 50 to 60 years. The texts mainly deal with the distribution of rations to the dependants of the palace or of the temples. Of particular importance are the singers designated as nar, who receive presents from the king - a privilege, which shows their reputation and how honourably they were treated. The king obviously remunerated persons belonging to the elite and who served to anchor the ruler's esteem and reputation within society.[26] Royal hymns also mention that the nar-singer was responsible for the propagation of royal achievements well into the future.

Despite the unattested exchange of court musicians in the Ur III period we can still trace the movements of musicians within the empire. However, long-distance journeys are rarely attested. Mobility may be tracked down in documents either by explicit reference or indirectly by prosopographic observations - a rather tedious task, which, however, presents additional evidence on mobility. The Ur III evidence supports the general view that the attested travelling singers are high ranking individuals:

1. nar lugal

The most prestigious musicians were the royal singers, the nar lugal. 'Messenger texts' from G̃irsu provide information on the goods that certain individuals received. Two of the well known royal singers, Urmeš and Lulum received bread when they came from Susa, travelling with the $sugal_7$-court official und a lu_2-$kaš_4$-messenger.[27] Susa was part of the Ur III empire and is often named as a destination in messenger texts. However, no specific reason is given for those numerous travels to the North-East. Since some temples in Susa had been built by Šulgi, and some messenger texts say that the kings' statue, the kings' offerings and animals were brought to cities of the East, it may be assumed that the musicians too travelled to Susa for their performance at ceremonies. (Susa → G̃irsu)

In contrast to his contemporary Ur-Ningublaga who only appears in the royal archives of Ur and Drehem, Urmeš is attested in the provincial archives of G̃irsu,[28] where he and his family lived, and those of Umma, where he received a royal present.[29] The evidence suggests that he was responsible for the organization of the royal cult in the province and therefore travelled within the Ur III empire and beyond. As for a certain Lulum, otherwise unattested, it may be assumed that he was reimbursed in the course of the Šulgi-festival, which took place in the month (vii) in which the document was dated. Other administrative tablets demonstrate the singers' participation at this festival taking place in month vii of the year: For instance the well-known

Ur-Ningublaga receives various containers (13^{dug} nii$_2$ 5 sila$_3$ and 4^{dug} nii$_2$ 4 sila$_3$) for the organization of a ceremony (izim ^{d}Šul-gi ba-AK i$_3$-zi) at Ur.[30] Again, in ITT 2, 822 (00/7) an anonymous nar lugal from G̃irsu receives bread on this occasion at which 'The king has set a festival for Narua (stele)' (lugal izim ^{d}Na-ru$_2$-a-še$_3$ i̯en-na). This is the name for the pilgrimage to the stele which is also called eš$_3$-eš$_3$ festival. (Ur → G̃irsu/Gu'abba) Here, Šulgi's journey from G̃irsu to the stele in Gu'abba (MTBM 260) is said to have taken place on the 3rd day of the month. The nar (and) gala ^{d}Šul-gi ('singers of the temple of Šulgi') participated at this ceremony and received 5 litres of oil for 'rubbing' (ba-ab-šeš$_4^{h}$).[31] The eš$_3$- eš$_3$ festival is also mentioned in an unpublished text from Irisai̯rig which is located north of Adab and closely linked to the royal house: according to David Owen's communication, a nar lugal received a substantial amount of rations in Irisai̯rig possibly for the eš$_3$-eš$_3$-festival at the royal place (eš$_3$-eš$_3$ ki lugala-še$_3$). (Ur → Irisai̯rig)

In the messenger text WMAH 238:22 (12/25) from G̃irsu Ur-Suen nar ⌜lugal⌝ receives beer, bread and oil (5 sila$_3$ kaš 3 sila$_3$ inda$_3$ 2 gin$_2$ i$_3$) together with other notables, among them the princes Puzur-Eštar and Nabi-Enlil. Obviously the royal singer accompanied a mission involving the royal family on their way to or from the capital city. An identification with the Ur-Suen nar in the document WMAH 23: r. i 5 (ŠS 6/12) from Umma is possible: here, the nar is said to having received 2 gin$_2$ (about 16,6 grams) of silver from the palace in Tummal, an agricultural sanctuary in the vicinity of Nippur. Also the identification with the Ur-Suen nar among recipients of pomace from the palace (zi-ga ka e$_2$-gal-ka) in another document from Umma (YOS 18, 57) from the year ŠS 2, sealed by the king, is likely. Interestingly the gala Dada, who appears regularly with royal singers is also listed in this text. (G̃irsu --- Tummal --- Umma)

The mobility of singers can also be assumed from a list of the best known Ur III royal singers who received goods in Nippur, the religious centre of the empire.

- Urmeš

AS 1/1/23: Urmeš receives one ox, issued by Enlila (Nippur): no special occasion mentioned in connection withthe expenditures for offerings listed before (*ARRIM* 4, 13: 17)

- Ur-kikuga or Ur-dukuga

AS 4/3: Ur-ki-ku$_3$-ga nar receives five textiles in Nippur, Papanšen acts as a maškim ('administrator'), issued by Dudu (*AUCT* 1, 229: 3)

- Balala

ŠS 6/5: Balala receives a silver vase as a present, Puzur-Eštar acts as a maškim; here, also silver for the palace in Nippur is mentioned (1/3^{šа} ku$_3$-babbar ša$_3$ e$_2$-gal-še$_3$); issued by Ludiḭira in Nippur *(SAT* 3, 1754: 2)

- Šu-Suen-migir-Eštar (without the designation nar[32])

ŠS 8/2/5: Šu-Suen-migir-Eštar, son of Dada gala, receives 4 silver rings 'because he played the *sabītum*-instrument' (mu ^{giš}sa$_2$-bi$_2$-tum x in-tag-tag-[ga-še$_3$]), Šu-Šulgi acts as a maškim, issued by Ludiḭira in Nippur (*JCS* 10, 30, 9: 10)

Explicitely the reason for the expenditure is never clearly stated. In all cases however, high-standing musicians received precious objects, such as textiles or a silver vase as a present, or cattle. In all cases it can be assumed that the royal musicians were paid for their performance on certain occasions, mainly for cultic activities and festivities. The playing of the *sabītum*-instrument, a cordophone, might have taken place during the Gusisu-festival in the name of Nippur's city god Ninurta, which was celebrated every year in the second month.[33] Note that this instrument, a horizontal harp, the 'instrument from Sabum',[34] might be the same instrument mentioned in the exchange between Mari and Ḫazor, the *šebitum* which is requested by the king of Ḫazor. As Krispijn showed in his article (*ICONEA* 2008) this instrument is mentioned in literary texts, the hymn of Šulgi, in the lexical texts from the 2nd and 1st millennium B.C. and in the craftsmen-archives of Isin. (Ur → Nippur)

The female singer Šulgi-nūri is also attested with an instrument: She and the royal singer Balala receive two silver rings for the transport of the *marītum* instrument 'when the king drank beer in the house of Niridagal', ensi$_2$ of Umma, as in AUCT 1, 942 (AS 2/2) from Drehem. (Ur/ Drehem → Umma)

According to the messenger text MVN 21, 363: r. 3 (ŠS 3/7) from Umma Šulgi-nūri received a variety of natural products, while Balala, Ur-Ningublaga's successor in the reign of Šu-Suen, happens to be associated with the ensi$_2$ Niridagal in Umma[35] and female singers at Umma: female singers attached to him[36] and the female singer of Niridagal.

X/X/X: the female singers (nar-munus) of Niridagal receive reed for torches (300] sa gi gi-izi-la$_2$) from Balala via Šu-Suen-Ḫamati(l)[37] (UTI 5, 3495: r.5)

Balala presumably appears together with singers of the temple of Šara:[38] here, we have another hint at the close relationship between the royal household and the Šara temple singers since the female royal singer Šī-šarrat, who resides there and later dies among the Šara temple singers in Umma.

Taddin-kiza is female royal singer of Ninkalla, a lukur, or second wife, of Šulgi. She is known from the royal archives of Ur and Drehem, receiving cattle and silver rings. Since Taddin-kiza is listed together with the wet nurse of a princess, she might have been responsible for the nursing and education of the royal household children. She also appears together with Šī-šarrat another female royal singer and later singer of the Šara temple at Umma. In ASJ 15, 77, 3: 3 (AS 9/9), Taddin-kiza receives a royal present in Umma, where she is mentioned together with Lu-Šara, who might be identified with the nar-igi-lugal(-ka) ('the king's singer')[39] and who acts as an overseer (ugula) in this context. (Ur/Drehem → Umma)

An interesting case is of the royal singer Nagu'udu, who is mentioned in several month and year accounts (HSS 4, 3 (AS 2/12)) as the recipient of a large amount of sesame oil (600 litres!) and dates, which he received for the mouth-opening ritual. Additionally, he receives oil for the anointment of parts of a cultic boat. Most probably Nagu'udu can be equated to the jester (u_4-da-tuš)[40] Na-gu-du (instead of the spelling Na-gu-u_2-du), who is dated to the years AS 2 and 3 in the state archives of Drehem. This profession is closely associated with the handling of bears. In MVN 19, 8 (00/2), a messenger text from G̃irsu, Na-gu-du (without mentioning a profession) receives beer, flour and oil (0.0.1 kaš 5 $sila_3$ zi_3 1 i_3 a_2-gam) as a present (nii_2-ba Na-gu-du-$še_3$ du) from Šu-Enlil, the court official ($sugal_7$). The royal singer Nagu'udu receives 600 litres of oil from the $sugal_7$ lugal Šu-Enlil.[41] Both expenditures, which date to month ii, can be linked to the mouth-opening ritual. I presume that both Na-gu-du and Na-gu-u_2-du must be the same person, which makes the identification of the nar with the jester very likely.[42]

Since bears strived in the mountains of Northern Mesopotamia, Syria and Iran, it may be surmised that their trainers, or jesters, did not come, originally, from Southern Mesopotamia.[43] In this light one might refer to the Drehem text TCL 5, 6036, mentioning a jester identified as 'the man from Mari' (lu_2 Ma-ri^{ki}), who receives several natural products. (?(Syria)?) --- Ur/Drehem → Girsu)

2. nar-gal

Also nar-gals, 'senior singers', were counted among the high-standing individuals, who are usually associated with the temple and are mainly attested in provincial archives. An anonymous nar-gal, was reimbursed with a special kind of bread (2 $sila_3$ $inda_3$-sal?-la?) for a journey (mu-kaskal-$še_3$) according to MVN 13, 591 (X/9/14) from Nippur. He is listed among other singers (nar), who received soup, beer and bread. Among the rest of the recipients, high-ranking persons such as the driver (lu_2-$kiri_4$-dab_5), the overseer (NU-$banda_3$), the cult official (zabar-dab_5), wives of the court ($sugal_7$) and another cult official (zabar-dab_5) are named. This might be evidence for travelling musicians accompanying a diplomatic mission from Ebla and Mari, where high-standing court musicians, the nar-gal, travelled with notables to prepare wedding negotiations. The evidence gathered on nar-gals suggests that in contrast to the nar lugal, who perform musical tasks, the nar-gal was occupied with administrative tasks.

Mobility can also be assumed for the nar-gal Dada, who is attested in the reign of Šu-Suen in various documents from Nippur, Umma and Ur.[44] In both cities he appears among the sealing individuals; in Ur and Umma he receives parcels of land. (Nippur --- Umma --- Ur)

3. Various accompanying singers

An anonymous nar zabar-dab_5, that is the singer of the highest cultic functionary of the state, is known from the Umma text OrSP 47-49, 477: 5 (5/25), in which he receives beer. This nar zabar-dab_5 is listed together with some mar-tu people, *i.e.* Amurru-people from the north-eastern area of the Ur III empire, 'of the house' and 'sitting in front of the king' ($ša_3$ e_2) and (igi lugal-$še_3$ tuš-a) and a 'man of the small boat' (lu_2 ma_2-tur). Šar-ilī, the $sugal_7$-court official acts as the maškim-administrator of this group of people who might have been travelling together (to the king?). Otherwise singers of the highest cultic functionary of the state appear only in a document from the royal archives of Drehem: in

AUCT 1, 190 from the 2nd year of Amar-Suen the nar-munus zabar-dab$_5$-me, the female singers of the zabar-dab$_5$, receive two goats. In this case the zabar-dab$_5$ may be identified with Enlil-zišagal, who is closely associated with the king and who could also have been an en-priest of Nippur.[45] Furthermore well-known royal singers received animals from the zabar-dab$_5$. (Ur/Drehem → Umma)

In ASJ 2, 33, 92 (AS 6/2), at G̃irsu, barley (183.3.0 še gur lugal) is distributed to the nar-balaḫ (tigi$_2$) 'harp musicians' and 'highlander guards' (Elamites and soldiers) by Urnumušda. These 'highlander bodyguards' could be counterparts of native guardians who had come from Elam and worked temporarily for the masters of the officials they guarded. As Michalowski[46] recently showed, they were often reimbursed for their accompaniment of envoys and messengers. Unfortunately, it is not clear if harp players also originated from Elam.

In another messenger text from G̃irsu, HLC 163, pl. 103: 11 (6/4), Šu-Dumuzi, who normally acts as a court official (sugal$_7$) or a messenger (lu$_2$-kaš$_4$), is accompanied by an unnamed singer (nar-da du).

Additionally the following entry in the messenger text DAS 145 (X/11/28) can be related to travelling singers: here, Imtidam receives oil (2 gin$_2$ i$_3$ (16,66 grams): nar-še$_3$ ḫen-na 'who went for singing/doing music'. In this case it is obvious that Imtidam was actually performing on his travels. However, the identification of Imtidam remains obscure. Since this messenger text is undated one has to rely on prosopographical observation: Thus Imtidam could be identified as the chief administrator of a temple, a šabra.[47]

Since anonymous nar ra$_2$-gaba, 'singers and riders/messengers' appear closely together in two texts from the provincial archives of Umma and Ḫirsu one may assume that they might have been travelling together and have been compensated for their efforts, together. But the evidence is not conclusive in this respect.

- SAT 2, 513: 12 (Š 46): the nar ra$_2$-gaba receive 6 bundles of reed from Gatie via Būr-Mama (Umma)
- MVN 9, 172: r. 5 (Š 43): the nar ra$_2$-gaba receive 0.0.4 2 sila$_3$ flour (dabin) as a regular delivery/offering for 1 month (sa$_2$-du$_{11}$ u$_4$-1-kam iti-1-še$_3$) from Gatie (G̃irsu)

nar ra$_2$-gaba-me are also attested in the list RTC 399: r. ii 25 (IS 3) from G̃irsu: here, those belonging to this group are called 'SIG$_7$-a' (si$_{12}$-a) 'blind'[48] people and receive rations. The nar ra$_2$-gaba-me belong to the e$_2$ En-ki A-UR$_2$ u$_3$ En-ki ša$_3$ iri (Gu'abba, Enki temple). Only Urukibi of the four listed individuals having names may be identified with the gala from Gu'abba attested in UDT 57 (Š 34) in a payroll (ku$_3$-la$_2$-še$_3$). All of them seem to be sons of a prostitute (geme$_2$-kar-KID).

More evidence from Umma has been recently published. Along with various professionals, among them snake charmers and gudu$_4$-priests, ten young singers (nar-nita$_2$) are listed. They were supervised by Lu-Šara, the overseer. All of them belonging to different institutions are known as erin$_2$ kaskal-še$_3$ ḫen (soldiers/working men who went on a journey). The onymous singers, probably, were members of the Šulgi- and Šara-temples. It it is unclear whether they went on a journey or a military campaign. (Nisaba 24, 23: r. ii 23, IS 3)

In Nisaba 24, 29: r. i 11 (AS 3/10), a document from Drehem, Dada nar receives provisions (igi-kar$_2$) of bread and beer (0.2.3 inda$_3$ ḫen and 0.2.3 kaš ḫen gur) in an expenditure as a temple functionary (lu$_2$ mar-za), who travelled to Umma. It is unclear whether this Dada nar is to be identified with aforementioned Dada nar-gal. (Drehem → Umma)

In UET 3, 1113 (X/5) young singers/apprentices (nar-tur-tur) of A-na-a received bread-rations (inda$_3$-ḫen). In the same text a messenger (lu$_2$-kin-gi$_4$-a), travelling to Uruk received a special type of bread (inda$_3$-sig$_5$) and one might wonder whether the young singers accompanied him on his journey. It is very likely that those young singers belonged to the e$_2$-umum, the academy of Ur.[49] Connections between Ur and Uruk are also attested in U. 31274, where an anonymous nar unug^{ki} (Uruk) receives a delivery/offering (sa$_2$-du$_{11}$) of oil and bread. (Ur ↔ Uruk)

4. nar in festive/cultic context

In the account of rations (Orient 16, 77, 117: iii 16 (n. d.)) from G̃irsu amar-ku$_5$ (castrati?) and nar, who came from Nippur (Nibru^{ki}-ta ḫen-na) receive rations of sesame oil for anointment. This expenditure might be understood as part of a royal banquet at Tummal (kaš-de$_2$-a lugal ša$_3$ tum-ma-al^{ki})

during which oil is distributed in the preceding entry of this account. (G̃irsu → Nippur/ Tummal)

Singers and musicians belonging to the temple also travelled to other towns to attend ceremonies. Two texts from Ur attest of a nar and a gala from Ur who receive various natural products in Ga'eš (Karzida): In UET 9, 412 (IS 2/10) they are known as the $eš_3$ $ĝe_6$-zal-$še_3$ 'sanctuary, where one spends the night'[50] together with $gudu_4$-priests and other personnel (lu_2 $didli_2$-ne) at a meal (nii_2-ku_2-a). This ceremony belongs to the izim-maḫ ceremony in Ga'eš situated closely northeast of Ur. In U. 30591 (IS 5/7) the nar gala $Urim_2^{ki}$ receive along with other temple personnel, an inspector (NU-$banda_3$) and Elamites, bread and beer in Ga'eš. The name of the town and the month-name show that this expenditure might have been for the Akiti-festival, one the most important festivals of the state, which, according to literary texts, was accompanied by musical performances including the $^{kuš}ub_3$-drum and $^{kuš}a_2$-la_2-instruments. (Ur → Karzida)

Some singers, also temple singers, shifted between ceremonies and their original workplace, for tasks unrelated to music. In the Drehem document TRU 41 (Š 41/8) it ist said that 10 onymous females returned from the singing for the new moon, the $eš_3$-$eš_3$-festival[51] to the weaving mill (nar-ta gur-ra $eš_3$-$eš_3$ u_4 šakar-ka).[52]

They have been taken over by Ubārum, the ugula ('overseer') of the mill. It is no fully clear to which institution they belonged. But since we know of other temple singers at Šara in Umma, who shifted between their musical tasks and work at the mill, it seems likely that this group of ten also belonged to the temple. However, since many of them carry Akkadian names one could also carefully speculate whether they belonged to the yet unattested royal harem.

5. nar at work in non cultic/musical context

A non-cultic/musical context is attested in the account ASJ 9, 117, 47 (Š 41) from Ḥirsu: here, two onymous singers from the village Kuli ($ša_3$ e_2-$duru_5$ Ku-li) deliver barley. Unfortunately, this is the only attestation for those two onymous individuals (Ur-Enki and Ur-Šulpae) and nothing more is known about the village Kuli. (Kuli → G̃irsu)

Another example for work that caused individuals to travel is Ur-^{d}Hendur-saḭ nar from G̃irsu (nar $G̃ir_2$-su^{ki}-ta) who is mentioned in several lists of workers dating to various months of AS last year and ŠS first year. He was among the ḭuruš-workers, who had to perform work-duties for the state in the mill of Saḭdana. Saḭdana is a variant of the toponym Esaḭdana, which is the Sumerian name of[53] Pruziš-Dagān/Drehem. As Sharlach showed, the province of Lagaš had to supply workers for the mill Puziš-Dagān for certain months of the years.[53] (G̃irsu → Drehem)

A group of 43 singers (guruš nar?) is listed among 182 guruš-men and $geme_2$-females in the administrative document MVN 15, 390: r. xi 19 (Š 37/7) from Umma. These men belong to a group of various craftsmen who were paid by the day and described as: ⌜Umma^{ki}⌝-[ta Tum]-⌜mal_X⌝ [^{ki}-ka-$še_3$] ('from Umma to Tummal (sacred quarter in Nippur)'). Since these people are known as guruš and $geme_2$, it is assumable that these male nar-singers were employed for simple non-musical tasks. Also the important figure of 43 individuals belonging to this group reinforces this assumption.[54] (Umma → Nippur/Tummal)

In YOS 4, 292 (Š 46) the nar Ka-zal-lu^{ki} (group ?) receives 3 pisaḭ tab-ba kuš si-ga ('baskets covered with leather'). This is quite an unusual expenditure (zi-ga bala-a kišib lugal-izim), which might be connected to the origin of the singer(s). Kazallu is located about 22 km north of Marada. The singers might belong to the local $ensi_2$ Ka-la-mu, who is attested in texts from Drēhem and Umma. (Kazallu → Umma)

Conclusion

Among singers travelling either alone or in groups, it is clear that among them were individuals of differing social standing. Their status is defined either by their designation (nar lugal, nar-gal or simply as guruš-men), or by their task. According to the Ur III archives, male and female mobility is for the purpose of:

- the accompaniment of delegations and as messenger of the court
- cultic or festive ceremonies, probably directly associated with musical activities. Musicians

are thus responsible for the tradition of musical, religious as well as political issues.

- for (communal) work in the fields, mills and gardens or as a carriers, most probably not associated with musical tasks.[55]

Mobility is mainly dictated by economic and administrative criteria, which Zaccagnini[56] described as *redistributive mobility*. There is no reference to commercial mobility. In most cases individuals cited are linked to the palace, and in fewer cases to temples. There are only few references to individuals. These cannot be clearly associated to palace or temple. Reciprocal mobility, which acts according to 'rules' of gift-exchange or dissident mobility are not yet found in Ur III material. It is hopefull that in the future material from harem singers might reveal more on this matter.

Notes

1 →, ↔ … direction of movement, --- … unknown direction of movement, AS = Amar-Suen; IS = Ibbi-Suen; Š = Šulgi; ŠS = Šu-Suen.

2 See *e.g.* Michalowski, P., A Traveller's Tales: Observations on Musical Mobility in Mesopotamia and Beyond, in: ed. R. Dumbrill & I. Finkel, *ICONEA 2008*, Lulu, USA 2010, 117-124. This article focuses on musical mobility based on observations on the use of names of musical instruments.

3 Pruzsinszky, R., Die königlichen Sänger der Ur III-Zeit als Werkzeug politischer Propaganda, in: ed. R. Pruzsinszky & D. Shehata, *Musiker und Tradierung, Wiener Offene Orientalistik 8, Wien 2010*, 96-97.

4 von Lieven, A., Music Archaeology Music Philology, Sources on Ancient Egyptian Music and Their Inherent Problems, in: ed. E. Hickmann & R. Eichmann, *Studien zur Musikarchäologie IV, Musikarchäologische Quellengruppen: Bodenurkunden, mündliche Überlieferung, Aufzeichnung, Vorträge des 3. Symposiums der Internationalen Studiengruppe Musikarchäologie im Kloster Michaelstein, 9.-16. Juni 2002, Orientarchäologie 15, Rahden (Westf.)* 2004, 101.

5 The most recent comprehensive treatment on the musicians at Mari is by Ziegler, N., Les Musiciens et la musique d'après les archives de Mari, *Mémoires de N.A.B.U. 10 (= FM IX), SEPOA* Paris 2007.

6 Ziegler, N., Teachers and Students, Conveying Musical Knowledge in the Kingdom of Mari, in: ed. R. Pruzsinszky & D. Shehata, *Musiker und Tradierung, Wiener Offene Orientalistik 8, Wien* 2010, 125.

7 Ziegler, N., (2010) 126.

8 Ziegler, N., (2007) 100 on M.6851 (= FM IX 13).

9 Ziegler, N., (2010) 125-126.

10 This information has been kindly provided by Gernot Wilhelm.

11 For more attestations of musicians as part of the royal loot see Teppo, S., *Women and their Agency in the Neo-Assyrian Empire, Helsinki* (2005) 66-67. (http://ethesis.helsinki.fi/julkaisut/hum/aasia/pg/teppo/womenand.pdf)

12 Bleibtreu, E., Ein vergoldeter Silberbecher der Zeit Assurbanipals im Miho Museum: Historische Darstellungen des 7. Jahrhunderts v. Chr, *Archiv für Orientforschung Beiheft* 28, Wien 1999. See also P. Albenda's review in The Journal of the American Oriental Society 121 (2001) 145-146 with a discussion on the goblet's date and provenance.

13 Borger, R., *Beiträge zum Inschriftenwerk Assurbanipals, Wiesbaden* 1996, 227.

14 Ziegler, N., Le Harem de Zimrî-Lîm, La population féminine des palais d'apres les archives royales de Mari, *Mémoires de N.A.B.U.* 5 (= FM IV), Sepoa Paris 1999.

15 For instance HSS 13, 199, 403 and 498, HSS 14, 502 and 599, HSS 16, 370+NTF M 16 and SMN 2731 with singers from Babylonia and Ḫanigalbat. See, Lion, B., Les femmes du roi d'Arrapha d'après quelques documents administratifs de Nuzi (XIV^{e} siècle av. J.-C.), in ed. J.-C. Cassard et al., 'Le prince, l'argent, les hommes au Moyen Âge.' Mélanges offerts à Jean Kerhervé, Collection *'Histoire'* Rennes 2008, 20-22. On various ethnic backgrounds of singers in Middle Babylonian

sources see Sassmannshausen, L., Beiträge zur Verwaltung und Gesellschaft Babyloniens in der Kassitenzeit, *Baghdader Forschungen* 21 (2001) 101 (palace personel, persons on the run or deceased individuals).

16 See Kinnier-Wilson, J.V., The Nimrud Wine Lists, A study of men and administration at the Assyrian capital in the eighth century B.C., *Cuneiform Texts from Nimrud*, I, London 1972, 76f., Teppo (2005) 65ff. and Westenholz, J.G., Oral Traditions and Written Texts in the Cycle of Akkad, in ed.: M. F. Vogelzang & H. Vanstiphout, *Mesopotamian Epic Literature, Oral or Aural, Lewiston*, Canada (1992) 15074 for parallels.

17 Archi, A., The Singer of Kanesh and his Gods, in: ed. M. Hutter & S. Hutter-Braunsar, *Offizielle Religion, lokale Kulte und individuelle Religiosität, Alter Orient und Altes Testament* 318 (2004) 11ff., Schuol, M., Die hethitischen Sänger und die Tradierung altanatolischer Musiktraditionen, in: ed. R. Pruzsinszky & D. Shehata, *Musiker und Tradierung,* Wiener Offene Orientalistik 8, Wien 2010, 135-149.

18 Passage of Šulgi Hymn B cited according to the Electronic Text Corpus of Sumerian Literature: http://etcsl.orinst.ox.ac.uk/cgi-bin/etcsl.cgi?text=t.2.4.2.02#

19 Early Dynastic Administrative Tablets of Šuruppak, Napoli 1994, 53.

20 See *e.g.* Tonietti, M.V., Musicians in the Ebla Texts: A Third Millennium Local Source for Northern Syria, in: ed. R. Pruzsinszky & D. Shehata, *Musiker und Tradierung*, Wiener Offene Orientalistik 8, Wien 2010, 67-93.

21 TMH 5, 115: 3.

22 TMH 5, 67: r. vii 9.

23 Old Akkadian School Texts, Some Goals of Sargonic Scribal Education, *Archiv für Orientforschung* 25 (1974-1977), 110

24 The e_2 uz-ga is understood as a sacred area of the temple: Selz, G., *Welt des Orients* 26 (1995) 196.

25 Here, in iv 9-11 singers receive another ration for their balaḭ-instrument (ki balaḭ-$še_3$).

26 Pruzsinszky, R., (2010).

27 Berens 91: 19 (00/6) and MVN 5, 248: 10 (00/7/1).

28 ITT 2, 928: 7.8. r.2 (ŠS 4).

29 OrSP, 47-49, 384: 3 (AS 9).

30 UET 3, 80 (00/8).

31 HSS 4, 95 (00/7).

32 According to BIN 5, 29: 11 (ŠS 4/1/18) Šu-Suen-migir-Enlil can be identified as a nar.

33 Sallaberger, W., *Der kultische Kalender der Ur III-Zeit,* Berlin 1993, 114-122.

34 District in the Zagros between Dēr and Susa in North-Western Iran.

35 Also the 'the man (lu_2) of Niridagal, the singer' who receives a ration of flour in TCS 297: 5 (X/0/17) may be identified with Balala.

36 OrSP 47-49, 456 (ŠS 9): receipt of grain.

37 This individual might be identified with Šu-Suen-Ḫamati šu-i in AUCT 2, 378 (ŠS XX/00/08), who acts as a maškim.

38 To be shown elsewhere.

39 TCL 5, 6058: 14 (AS 5/4): see Falkenstein, A., *Die Neusumerischen Gerichtsurkunden,* München 1956-157, 147 and Oh'e, S., The Terms Lú ki-ba gub-ba and Lú-mar-za ki-ba gub-ba in the Ur III Texts, *Acta Sumerologica Japonica* 2 (1980) 1377.

40 Römer, W.H.Ph., Der Spaßmacher im alten Zweistromland, Zum 'Sitz im Leben' *altmesopotamischer Texte*, Persica 7 (1977) 43-68. (Röme translated the term u_4-da-tuš 'der auf der Ziege sitzt', 'Ziegenreiter'.)

41 The $sugal_7$ Šu-Enlil is often named in messenger texts as a traveler (from and to Anšan) and can also be identified with one of the sons of Šulgi: Boese, J., Sallaberger, W., *Altorientalische Forschungen* 23 (1996) 37-38.

42 From temple personnel-lists in Lagaš we know that jesters were counted among the nar: see Gelb, I., Homo Ludens in Early Mesopotamia, *Studia Orientalia* 46 (1975) 61-64 (Gelb translated the term as 'bear ward').

43 On jesters see Foster, B., Animals in Mesopotamian Literature, in: ed. Collins, *A History of the Animal World in the Ancient Near East, Handbuch der Orientalistik* I/64 (2002) 287.

44 Nippur: NRVN 1, 184: 1 (ŠS 7/3), Ur: UET 3, 1357: 33 (ŠS 9), Umma: JCS 54, 2, 8: 1-2 (ŠS 7/5).

45 This information has been kindly provided by Huber-Vuillet, F.

46 In: Observations on 'Elamites' and 'Elam' in Ur III Times, in ed.: Michalowski, P., On Ur III Times: Studies in Honor of Marcel Sigrist, *Journal of Cuneiform Studies Supplementary Series* 2008, 109-124 (esp. p. 111 on this text).

47 TCTI 2, 650: 3 (6/7), TÉL 250: ii 3 (Š 25), MVN 5, 203: ii 5 (ŠS 8) and TÉL 262: r. 7 (IS 1).

48 Heimpel, W., Blind Workers in Ur III Texts, *KASKAL* 6 (2009) 43-38.

49 Pruzsinszky, R., (2010) 113 and Michalowski, P., Learning Music: Schooling, Apprenticeship, and Gender in Early Mesopotamia, in: ed. R. Pruzsinszky & D. Shehata, *Musiker und Tradierung, Wiener Offene Orientalistik* 8, Wien 2010, 201-203. Note that a ki-umum with female and male nar-singers is attested in the newly published list YOS 15, 119: 9 from Umma.

50 Sallaberger, W., (1993) 178835.

51 Sallaberger, W., (1993) 39-41 (see footnote 171 on TRU 41) and 68.

52 One of them is šu bar-ra, which means that she is released and can go wherever she wants to. All the other singers are marked with a '1/2' sign.

53 Provincial Taxation and the Ur III State, *Cuneiform Monographs* 26, Leiden 2004, 95.

54 The nar presumably occupied with musical tasks usually appear in much smaller groups of up to 20 persons maximum as a survey of the pertinent texts has shown.

55 Compare this range to the observations made upon messenger texts of the Ur III period by Sallaberger, W., Das Reich der Dritten Dynastie von Ur, in: ed. Attinger, P., & Wäfler, M., Annäherungen 3, *Orbis Biblicus et Orientalis* 160/3, Freiburg, Schweiz Göttingen (1999) 306-307.

56 Zaccagnini, C., Patterns of Mobility among Ancient Near Eastern Craftsmen, *Journal of Cuneiform Studies* 42 (1983) 145-164.

ON THE MANIPULATION OF THE PLANETS BY THE LYRE PLAYER IN A 'WINE SONG' BY KHAMIS BAR QARDAḤE[1]

Siam Bhayro

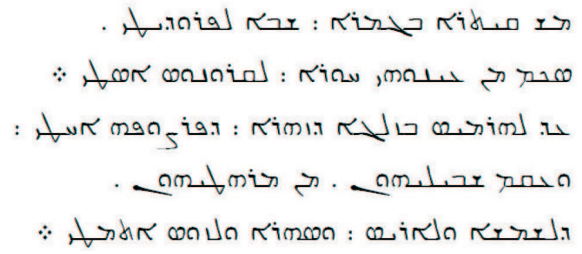
Introduction

In a previous paper, I discussed the theoretical basis underlying music therapy in antiquity, particularly among those of the Pythagorean School. Three points are worth recalling for our present purposes: First, the association of each note of the scale with a celestial sphere; second, the perception that the health of both the universe and humankind, as macrocosm and microcosm, are both dependent upon a proper attunement of their respective harmonia; and, third, the combination of lyre-playing and singing being preeminent in Pythagorean music therapy. It is my contention that the Greek sources are attempting to give a theoretical basis to a psychotherapeutic practice imported from the east, associating the manipulation of the lyre's strings with the harmonia of both cosmos and soul.[2]

In the present paper, this theme will be developed further with reference to a Syriac 'wine song' that appears to associate each of the lyre's seven strings with one of the planets, and imputes to the lyre player the power to manipulate each planet's orbit. This manipulation is described as perverting the course of the planets, yet it is also presented in what appears to be a wholly positive light. An explanation for this apparent contradiction will be sought in the Zoroastrian conception of the planets.

The poem in question was written by Khamis bar Qardaḥe, a Nestorian parish priest whose poems (both liturgical and non-liturgical) have ensured that his reputation has endured through the centuries. Khamis flourished in the late thirteenth century and lived, with his wife and children, in Arbela (northern Iraq).[3] Among his non-liturgical poems, there are approximately thirty 'wine songs', one of which contains a dramatic description of a lyre player. The identity of the lyre player is not stated—perhaps it is not important. What is important is his ability to manipulate the course of the seven planets as he strokes the seven strings of the lyre.

Text[4]



Translation

He stroked the lyre perfectly, he led Aphrodite (Venus) away captive;

he shot from his eyes a glance (*lit.* he formed a look), he caused Chronos (Saturn) to turn (*i.e.* to deviate from its course);

while Hermes (Mercury), with the splendour of the brightness of his visage, he caused to stray;

and he led their paths astray from their exertions–

so that the sun and Aries (Mars) and the moon and Zeus (Jupiter) were brought (aside).

Notes

The meter of the poem is clearly established with each line containing two sections, the first with seven syllables and the second with five. The effect of this meter is to give each line an abrupt ending, causing the listener to sit up and take notice. As well as having a strict meter, the poem also rhymes (compare the end of lines 1-3 and 5).[5]

The opening verb means 'to caress, grope, explore'. It is very sensual, and is certainly not the usual Syriac verb used for playing the lyre (*cf.* √NQŠ). The noun used for 'lyre' is a Greek loan word from κιθάρα. The five divine-planetary names in this poem are also Greek loan words. The reference to 'exertions' is possibly an error for 'courses' (*mrhṭyhwn* instead of *mrdythwn*).

Discussion

These lines clearly refer to the lyre player disrupting the usual paths of the planets. Summarising the Pythagorean approach to how music could manipulate the soul, Martin West wrote:

> The health of the body or of the soul could be explained as dependent on proper 'attunement', on harmonic relationships ultimately reducible to numbers. The whole cosmos, the planetary and stellar spheres with their orderly revolutions, could be seen as a vast musical instrument with each component attuned according to the same scheme of ratios as obtains in our mortal music.[6]

This theoretical basis for music therapy traveled east as part of the systematic transmission of Greek science and philosophy into the orient, first into Syriac and then into Arabic.[7] The idea that there is a relationship between the cosmos and the individual human being, as macrocosm and microcosm, each consisting of seven equivalent parts, finds expression in several Syriac sources, both theoretical/philosophical and practical/medical, that date to the same period as Khamis's 'wine song'.

In the former category, we can highlight some lines from a poem by Giwargis Warda who, like Khamis, also lived and worked in Arbela, albeit earlier in the thirteenth century.[8] In this poem, the human body's seven constituent parts and seven faculties are identified with the seven days of the week, which, as contemporary Syriac texts clearly show, were readily identified with the planets:[9]

ܐܦ ܒܗ ܫܒܥ ܦܓܪ̈ܐ ܕܒܗ ܐܝܟ ܕܫܒܥ ܝܘ̈ܡܬܐ
ܕܡܐ ܘܡܘܪܐ ܘܒܣܪܐ
ܘܓܝܐ ܘܥܨܡܐ ܘܟܣܐ ܕܥܒܕ ܣܥܪ̈ܐ
ܫܒܥ ܕܝܠܗ ܫܒܥ ܚܝܠ̈ܐ
ܩܕܡܝܬ ܕܝܠܕ ܠܢܦܫܗ
ܬܪܝܬ ܕܡܬܪܒܐ ܒܢܦܫܗ
ܬܠܝܬ ܕܡܬܐܣܐ ܒܢܦܫܗ
ܐܚܪܬ ܕܡܫܟ ܠܡܙܘܢܐ
ܘܐܚܪܬ ܕܡܬܪܒܐ ܒܗ
ܘܫܬܝܬ ܕܡܗܪܝ ܠܡܙܘܢܐ
ܘܓܡ ܒܗ ܫܒܥ ܚܝܠ̈ܐ ܕܒܗ ܐܝܟ ܕܫܒܥ ܝܘ̈ܡܬܐ

And there is in it also seven parts,
in the likeness of the seven days:
blood and marrow and flesh,
sinew and bone and a garment
of skin and hair that grows.[10]
Also it has seven powers:
the first that is giving birth to itself,
the second that is growing itself,
the third that repairs itself,
another the attraction of food,
and another that is nourishment,
and the sixth digests food,
also that which discharges that which is surplus.

In the latter category, consider the following lines from a twelfth-century encyclopedia of medical lore:[11]

ܡܢܐ ܩܪܒ
ܡܩܪܒ ܪܝܡ
ܡܐ ܫܝܢ
ܩܝܢܐ ܩܪ̈ܒ ܫܟܝܢ
ܩܝܒ ܠ
ܡܝܫ ,ܚܠ
ܫܝܫ ܒܪ ܩ
ܟ ܠܡܐ ܐܠ ܐܫܠ ܐܝܟ
ܩܝܢ ܩܪܒ ܩܠܝܢ ܐܡ ܩܝܒ
,ܡܐܟܝܡ ܐܩܒ ܩܝܢ
ܩܝܒ ܠ ܐܒܐ ܐܝܟ
ܩܪ̈ܒ ܡܐܢܩ ܚܠ ܐܦ ܟ
... ܩܝܢ ܩܪܒ ܚܠ ܡ ܩܝܒ
ܩܡ ܠ ܩܝ ܚܒ ܐܒ ܚܠ
ܟ ܫܝܫ ܩܝܠ ܩ ܩܝܠ

The sun—his marrow.
The moon—his skin.
Aries (Mars)—his blood.
Hermes (Mercury)—the sinews and arteries.
Bel (Jupiter)—the bones.
Belti (Venus)—his flesh.
Kewan (Saturn)—his hair.
Men have said that everyone who is born is from a mixture and consists of a mixture of seven. And just as the composition[12] of its members are formed and composed into one body, thus also all of its inner operations are a mixture of these seven authorities ... The Chaldeans[13] held these (opinions) but now the Christians do not associate with them.

It is interesting that the Christian compiler (or copyist) of this medical compendium stresses that such beliefs are not within the accepted bounds of prescribed Christian doctrine. The fact that these beliefs merited a detailed description, however, suggests that they were too important to ignore and probably were held by Christians.

Both of these texts show the intellectual context for Khamis's 'wine song'. It is not simply the case that the human listener can be manipulated by the seven strings of the lyre, with each string pertaining to a separate part of the body. The effect of the strings on the human body are the local manifestation of the universal effect that is upon the seven planets, which themselves play a role in governing the human body. In view of this, in what way could playing the lyre in order to disrupt the cosmic order possibly be beneficial? Why would a song appear to celebrate such a practice when intuitively it could only lead to cosmological chaos or ill health?

According to Bruce Lincoln, the Zoroastrian conception of the universe viewed the seven planets as evil powers, allied with the Evil Spirit (called Ahriman in Pahlavi) against the Wise Lord (Ohrmazd) and his allied powers—the twelve constellations. In order to limit the evil effect of the seven planets, the Wise Lord was said to have bound the five planets to the Sun and Moon, thus corrupting their intended paths. Ultimately, in the age to come, all planetary motion would cease along with history itself. But in the present age, in which time exists, it was deemed necessary for planetary motion to be thwarted— the planets were to be banned from following their intended paths.[14] In this context, the references in Khamis's 'wine song' to the turning aside, or corrupting, of the motion of the planets can indeed be viewed in a positive light. Doing so will temper their wicked influence, bringing harmony to both cosmos and individual. It appears, therefore, that, despite being a Christian priest who was writing under Islam in the sixth Islamic century, Khamis was preserving an attitude towards the planets that dates back to at least the Sasanian period—the final era of Zoroastrian dominance in Mesopotamia.

Notes

1 I would like to thank David Taylor (Faculty of Oriental Studies, University of Oxford) for giving me an advance copy of his paper on Khamis and his 'wine songs' (see note 3) as well as scans from Khadbshaba's edition (see note 4). The present paper is the fourth in a series. For the previous three, see Bhayro, S., 'The Madness of King Saul', *AfO*, 50 (2003/2004), pp. 285-292; Bhayro, S., 'He shall play with his hand, and you shall be well': Music as Therapy in I Samuel 16:14-23', in *Csepregi, I., (ed.), Ritual Healing in Antiquity and the Middle Ages*, (Florence, forthcoming); Bhayro, S., 'Ancient Near Eastern and Early Jewish Lyre Traditions', in Finkel, I., & Dumbrill, R., (eds), *ICONEA 2008: Proceedings of the International Conference of Near Eastern Archaeomusicology held at the British Museum December 4, 5 and 6*, 2008, (London, 2010), pp. 71-77.

2 See Bhayro, 'He shall play with his hand'.

3 For more on Khamis, and also on the 'wine song' genre, see Taylor, D.G.K., 'Your Sweet Saliva is the Living Wine': Drink, Desire, and Devotion in the Syriac Wine Songs of Khāmīs bar Qardāḥē', in Teule, H.G.B., Fotescu Tauwinkl, C., ter Haar Romeny, R.B., & van Ginkel, J.J., (eds), *The Syriac Renaissance*, (Leuven, forthcoming), which also contains a discussion of this poem.

4 The text is taken from *Khamis bar Qardaḥe, Memre wmushhata*, (ed. Khadbshaba, S.I.; Nuhadra, Iraq, 2002), p. 222.

5 On the use of meter in Syriac poetry in general, see Brock, S., *An Introduction to Syriac Studies*, (Piscataway NJ, 2006), pp. 8-10. Rhyme is not an original feature of Syriac poetry, but often occurs in later texts under the influence of Arabic poetry; see Brock, S., 'Syriac Dispute Poems: The Various Types', in Reinink, G.J., & Vanstiphout, H.L.J., (eds), *Dispute Poems and Dialogues in the Ancient and Mediaeval Near East*, (Leuven, 1991), pp. 109-119, p. 113.

6 West, M.L., *Ancient Greek Music*, (Oxford, 1992), pp. 233-234. Similarly, Joachim Braun wrote, 'The seven-stringed lyre was viewed as a reflection of the celestial harmony, and the soul itself was seen as a well-tuned lyre...'; see Braun, J., *Music in Ancient Israel/Palestine: Archaeological, Written, and Comparative Sources*, (transl. Stott, D.W.; Grand Rapids MI, 2002), p. 19. See also Levin, F.R., *Greek Reflections on the Nature of Music*, (Cambridge, 2009), pp. 5-6.

7 This is discussed in more detail in Shiloah, A., 'Jewish and Muslim Traditions of Music Therapy', in Horden, P., (ed.), *Music as Medicine: The History of Music Therapy since Antiquity*, (Aldershot, 2000), pp. 69-83, pp. 76-82.

8 For more information and a bibliography concerning Giwargis Warda, see Taylor, 'Your Sweet Saliva', especially note 28.

9 The text is taken from Gignoux, P., 'Un poème inédit sur l'homme-microcosme de Guiwarguis Wardà (13ème siècle)', in Gignoux, P., (ed.), *Ressembler au monde: nouveaux documents sur la théorie du macro-microcosme dans l'antiquité orientale*, (Turnhout, 1999), pp. 95-188, pp. 128-129, where a French translation is also provided. For the explicit association of the days of the week with planets in Syriac literature, see, for example, Wallis Budge, E.A., *The Syriac Book of Medicines: Syrian Anatomy, Pathology and Therapeutics in the early middle ages &c.*, (London, 1913), vol. II, p. 568.

10 'that grows' - there appears to be an error in the text here. See both the textual variant given by Gignoux, and his note to this section (neither of which resolve the problem)—Gignoux, '*Un poème inédit*', pp. 128-129, 180-181. Gignoux offers the translation 'les plantes', which is correct but makes little sense. Essentially, we require a participle form from the same root, but what we have is feminine rather than masculine.

11 The text is taken from Budge, *Syriac Book of Medicines*, vol. I, p. 517.

12 The Syriac noun can also mean 'melody', which possibly reflects the prevalent theoretical basis for music therapy.

13 According to the common usage of the time, this is probably a reference to diviners/magicians.

14 Lincoln, B., 'Anomaly, Science, and Religion: Treatment of the Planets in Medieval Zoroastrianism', *History of Religions*, 48 (2009), pp. 270-283, pp. 274-275, 278, 280.

DRUMS IN THE LATE XVIIIth DYNASTY OF EGYPT

Lise Manniche

Compared to strings and winds, drums are fairly simple instruments with limited acoustic possibilities. However, their use and popularity (*i.e.* their frequency of representation) undergo a significant development during their appearance on the Egyptian stage.

Before the Hyksos presence during the 14th to the 17th dynasties, there are but few examples of drums in Egyptian representation.[1] A barrel-shaped wooden drum, dated from its archaeological context to the 12th dynasty,[2] and a drummer's workshop in the Delta of 13th dynasty date[3] are the only recorded finds prior to the 18th dynasty. From then onward, barrel-shaped drums and round and rectangular frame- drums appear in a variety of contexts.

Barrel-shaped drums

In the New Kingdom (18th - 20th dynasties, 1550 - 1163 B.C.) this drum is primarily an instrument connected with the military, and we would expect to find it in scenes recording battles. In the 18th dynasty this motif was largely confined to symbolic representations of pharaoh triumphant, either lifting up a handful of slain prisoners (temple reliefs) or single-handedly overcoming a cluster of enemies (*e.g.* as decoration on chariots). The subject becomes fully fledged in the 19th - 20th dynasties, but the choice of signal instrument is restricted to the trumpet - the barrel-shaped drum is not in evidence. How-ever, we know from written sources that this is where it belonged even earlier. A unique text from the late 17th dynasty describes the interesting career of a certain Emhab. He had been practising his drum in secret, keeping his fingers strong and supple to extract a variety of sounds from his instrument. One day he was invited for an audition to show his skills against those of another contestant. Emhab beat his rival performing no fewer that seven thousand 'lengths'. The nature of such a 'length' is not known, but it must be a technical term, perhaps describing a figure or a rhythmical phrase. Having gained the position as army drummer, Emhab spent a whole year drumming every single day, following his king (Kamose?) on his campaigns (in Nubia?) and bravely executing every command until, finally, he was rewarded with a female slave, purchased for him by the king himself.[4]

Soldiers were employed in more peaceful contexts such as during religious processions, and this is where we find our drummers depicted. They appear early in the 18th dynasty during the reigns of Hatshepsut and Tuthmosis III[5] and continue during the reigns of Tuthmosis IV and Amenophis III,[6] often in the company of trumpeters. Towards the end of the 18th dynasty, the subject of this paper, Amenophis IV/Akhenaten (1353 - 1335 B.C.) restructured public and religious life with greater, soon exclusive, focus on the solar disc, in essence still the old solar deity Ra-Harakhty but in a new guise, and, in tandem with this, a new pictorial programme for temples, royal tombs and private tombs. Along with the neglect of traditional gods conventional religious processions were deleted from the pictorial programme. The barrel-shaped drum, however, makes a surprise entry in a different setting: in the royal palace as represented on the walls of one of the king's temples built during the first few years of his reign in the city of Thebes (modern Karnak) in Upper Egypt. These buildings were built of sandstone blocks of a specific, easily recognizable size (the so-called talatat measuring 52 x 26 x 22cm), with reliefs often at a rather small scale. One such block shows three ensembles of musicians in two registers (fig.1): in the upper register two groups comprising Egyptian women with Egyptian instruments (on the left), and Hittite men (on the right),

with their native instruments which had by then also become established in Egypt (lute, lyre).

Figure 1. Talatat from the temples of Amenophis IV/Akhenaten at Karnak showing Egyptian and Hittite musicians as well as a musician playing a barrel-shaped drum and clappers.

Then, in the lower register, a group of apparently Egyptian men clapping their hands and another beating a barrel-shaped drum. Elsewhere I have discussed the curious fact that the male musicians are all blindfolded, presumably in order to distance them from the powerful presence of the king.[7] There is no comparative material (at least not with a drum) that will enlighten us as to the reason for the presence of the drummer and hand-clapping men – had they been of Nubian appearance, they would, along with the Hittites, have been representatives of the northern and southern boundaries of Egyptian influence. It should be kept in mind that when the king graces the royal palace with his presence it was considered as a sacred building, and even the most mundane activities such as eating, drinking and occupying the royal bed acquire a ritual function.[8] The ensembles performing in the palace at this time (and this is virtually the only palace music that we know of at all)[9] take their inspiration from those seen at private functions all through the 18th dynasty. There are numerous ensembles depicted on the walls of the chapels of Akhenaten, with men and women playing all the instruments known from banquet scenes in the tombs of high officials,[10] but none of them contain the barrel-shaped drum included in an indoor musical performance. There is one example of an apparently similar situation to the one mentioned above, also from the temple of this king at Karnak, with drum and clappers (fig. 2). The figures on the left carry something which can only be the sedan chair of the king or another member of the royal family. This indicates an outdoor setting, a procession from palace to temple or vice versa, or, just possibly, because of the clappers being seated and hence static, in the courtyard of the palace.

Fig 2. Musician of Amenophis IV/Akhenaten playing a barrel-shaped drum on a talatat from Karnak.

When in his 4th or 5th year the king decided to build a new residence some 300km to the north at present-day el-Amarna these drummers do not seem to have followed him, for there is not a single trace of a barrel-shaped drum there – but this is perhaps an accident of survival?

We can gain a complete picture of a procession with drums in the reign of Akhenaten's successor, Tutankhamun (1333 - 1323 B.C.), at a time when all the gods were re-instated, notably Amun-Ra (fig.3). Here we find the barrel-shaped drum and people clapping their hands or clappers, sometimes with the addition of lute players and acrobats, and singing in the procession on the occasion of the annual festival of Opet, which celebrates the rejuvenation of the 'spirit' of the king.

Figure 3. Drummer in the Luxor temple from the reign of Tutankhamun.

Frame drums

With the possible exception of the Old Kingdom drum mentioned above, both the round and the rectangular frame drums first appear in the 18th dynasty but, whereas the round one continues in use until Roman times, the rectangular frame drum is only represented sporadically after the 18th dynasty.

Rectangular frame drum

The Egyptian Museum in Cairo boasts a splendid example of this drum (fig.4).[11] Its date in the early 18th dynasty is assured by its provenance, it having been found in connection with the tomb of the mother of Senmut, chief architect of queen Hatshepsut (1473 - 1458 B.C.). It has a double membrane of parchment glued to a wooden frame and measures approximately 74 x 40 x 6cm.

Figure 4. Rectangular frame drum from the 18th dynasty. Egyptian Museum Cairo.

To begin with this drum is connected with domestic, musical activities, being part of banquet ensembles including harps and double oboe as depicted in the tomb chapels of high officials.[12] One notable exception is a 'market scene' showing the delivery of goods from a royal expedition into Nubia: scented substances, sycamore fruits and fish.[13] The mayor of Thebes oversees the delivery. This is a unique scene for a tomb, not just at Thebes and in the New Kingdom, but for all periods at all locations. The drums are beaten by women present to express the feeling of joy and jubilation (spelled out in the accompanying hieroglyphic texts). The scenery as such was probably much more common than this one representation suggests.

The reign of Amenophis III (1391 - 1353 B.C.) is known for its excellency in woodcarving. This includes a representation of a young female in a transparent garment beating a rectangular frame drum on the handle of an 'unguent spoon'.[14] Scented substance and music belong in a festive ambiance, often with erotic undertones.

A new trend appears in the 'Karnak years' at the beginning of the reign of Amenophis IV/ Akhenaten. The motifs on the talatat blocks of his temples focus on the king offering to the sun disc, the Aten, in the temple, or being present in the royal palace (*cf.* the context of the barrel-shaped drums mentioned above), or en route from one to the other, and this is precisely where the tambourines come in, rectangular ones and, from now on, also round tambourines (figs. 5 a,b).[15]

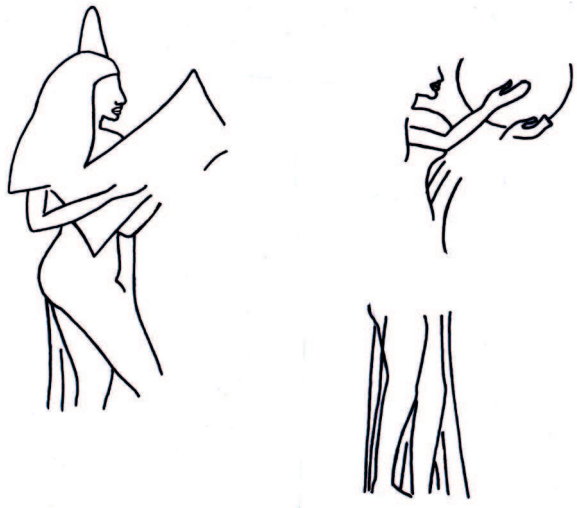


Figure 5, a and b. Rectangular and round drums from a street scene on a group of talatat from Karnak (from Smith and Redford 1976 pl. 43).

From the intimacy of a private banquet the rectangular tambourine moves out into the street, as in the 'market scene', to signal jubilation on the occasion of a royal procession.

When the king moved his residence north to el-Amarna, most of the motifs defined by his artists move with him, and we suddenly have a wealth of examples of such street music in temple decoration (fig. 6 and 7)[16] as well as in the tomb cha-pels of royal officials.[17] The reasons for finding them in this latter place are that prominent place is given to the royal reward, not an innovation as such, but elaborated in great detail at this period. Golden necklaces, ointment and other luxury items are thrown to the tomb-owner by the king from the 'window of appearances' in the royal palace. On his return home the owner is met by his wife and rejoicing neighbours, some of whom will play both round and rectangular frame drums. It was not a subject confined to the city of el-Amarna. A large slab from a tomb at Saqqara in the north, executed in 'Amarna' style, shows a crowd of women greeting the tomb-owner, no doubt on his

Figure 6. Street music at Karnak: relief now in Berlin (no. 759).

Figure 7. Street music at el-Amarna: relief now in New York.

return from a reward ceremony in the presence of one the last kings of the dynasty.[18] This subject of acclaiming women with frame-drums is continued in two Theban tombs from the time of Tutankh-amun and Ay respectively, just before the close of the 18th dynasty.[19]

The Amarna period has yet another interesting scene to offer which includes a round frame drum: women beat the drums near a tree (apparently desiccated) with a large bird. The relief was part of the decoration of the temple at el-Amarna, but it is not evident whether we are witnessing some ritual or a more mundane occasion (fig. 8).[20]

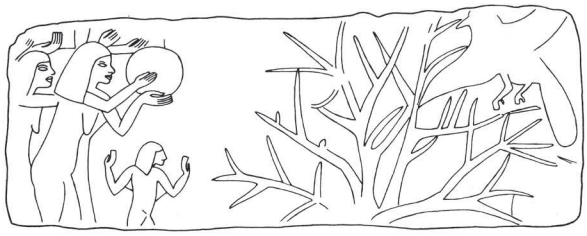


Figure 8. Talatat from el-Amarna, the Brooklin Museum, 60.197.

Round frame drums

In street music scenes the round frame drum appeared on equal footing with the rectangular one (fig. 5a,b). Two exceptions stand out: it was omitted in the 'market scene' in the mid 18th dynasty, and there is no example of a cosmetic spoon comparable to the one mentioned above.

On the other hand, it does appear alone, without its rectangular cousin, but in a specific context: in the hands of one of the most complex as well as popular Egyptian deities: Bes – whose name was probably not Bes until after the New Kingdom, but this is the name almost invariably applied to him. In the 18th dynasty his name was probably Aha.[21] At this time his field of operation was the world of women and the occupational hazard of being one, notably during conception and childbirth. We know of this Aha already in the Middle Kingdom, but in the New Kingdom evidence of the context becomes much clearer. He is an apotropaic deity, and for that purpose he may wave a knife – or beat a round tambourine to chase off harmful interference from demons and other creatures. Because of his role, he is often depicted on furniture such as beds, chairs and headrests as well as on toilet equipment which are exactly the items needed during conception, birth or the dangerous hours of the night. This subject appears to take off with a chair and a bed inscribed with the name of Satamun, daughter of Amenophis III, found buried in the tomb of her grandparents, Yuya and Thuyu, in the Valley of the Kings.[22] In religious thought, Bes/Aha is connected with the birth of the solar child - this is his reason for his escalating popularity especially at this time.[23] Along with knives the round frame drum becomes an established element of his iconography.

The theme of rejuvenation – and in a sense birth/rebirth – is reflected during the sed-festival, the jubilee celebrated by a king (in theory at least) after 30 years on the throne. One such occasion is depicted on the walls of the Theban tomb chapel of the steward of queen Tiy, consort of Amenophis III and mother of Amenophis IV/Akhenaten.

Among the episodes commemorated in his tomb are the celebrations which highlight the 'marriage' of the deities Ra and Hathor, in the guise of the king and queen, which will release the creative forces required for the dynamic continuation of the world, *i.e.* Egypt. In the sub-scene to this important re-enactment of the myth the round frame drum finds its natural place here in the hands of a young woman who is followed by a priest(?) wearing a lion (or Bes/Aha?) mask.[24]

The use of drums after the 18th dynasty

In Egyptian art there is a significant distinction in the depiction and choice of various subjects in the pre-Amarna New Kingdom (18th dynasty) and post-Amarna New Kingdom (19th - 20th dynasty), not to mention the subsequent periods. We should examine the further fate of the drums to find out if there is anything here which could add to our understanding of their role in the earlier period.

The barrel-shaped drum continued in military processions and is hence in the hands of men, and a development in its use only becomes apparent in the 25th dynasty when it may be played by women and in a non-military, but perhaps funerary context. In the Late Period Bes/Aha will also take over this drum along with most other musical instruments.

The clay drum was re-born in the shape of the darabukka in Arabian music. It is hard to believe that it disappeared at all in antiquity,[25] but it is not represented, and no extant examples have been identified.

Except for a few isolated cases of Late New Kingdom date[26] the rectangular frame drum is not depicted in wall-decoration after the 18th dynasty. Occasionally in figurines Bes/Aha appears to be handling a rectangular object, but this may be a summary representation of a lyre.

The round frame drum continued sporadically in street music.[27] Then something important happens which may be seen as a reflection of its use in the previous period: it becomes established as a sacred instrument in a birth-related context. A stela from the workmen's village of Deir el-Medina was set up by a certain Bukanefptah, wife of the foreman Kasa (owner of TT 10).[28] She is shown giving adoration to the goddess Nebethetepet. Below, she, her husband and other members of their family beat frame drums and wave sticks and stems of papyrus. This goddess also has the extended name of Hathor-Nebethetepet, or a different name, Iusaas. She looks like Hathor and is also present in the Hathor emblem on the left. She has a precise function (we know this from other sources): she is the 'god's hand' embodying the female principle required for creation with particular reference to the very first time, when the Ra-Atum initiated the process by masturbating with his hand.[29]

This is what this family is celebrating here by beating their frame-drums and reciting the invocations written above 'Praise to you etc... Be merciful to me that I may tell of your strength to all who know you not and all who know you. For all people come to you in crowds, men and women alike, and they say, 'Be merciful'... Every follower of her is in joy; no evil shall befall them, child after child'.

The same occasion, the festival of Nebet-hetepet, is celebrated on another stela also from Deir el-Medina (Turin 1656) (fig. 9). The name of the goddess is visible at the upper edge. This time rectangular frame-drums have been brought along by the wife(?) and three daughters of Netermosi who commissioned this little monument. These two stelae bridge the gap between popular street celebrations and the beating of frame-drums with a purpose beyond the here and now, enabling a communication with a goddess whose essence is the female element of creation. A rare example of a round frame drum of late New Kingdom date(?), previously published by the present writer,[30] emphasizes the connection between all the pointers mentioned above: the drum itself, females impersonating Bes/Aha, and divine presence in the form of Isis and Osiris (archetypical parents) and possibly Hathor.

The round frame drum continues to play this part in countless examples of the Graeco-Roman period, especially in the birth chapels. In the Late Period and Greco-Roman period we have numerous examples of the birth of a king or a deity being celebrated with the beating of round frame drums, and we may safely say that this particular ambiance goes back to the mid and late 18th dynasty.

Figure 9. Rectangular drum at the festival of Nebet-hetepet. Stela, Turin 1656.

Notes

1 El-Khouli and Kanawati 1990, pl. 44 (11b); Pérez Arroyo 2003, 230-232 (A), 316-317; cf. also a figurine in Chicago, ibid. 231-232 (B).

2 Hickmann 1949, 109-110, pl. 77.

3 Bietak 1985.

4 Černý 1969; Vandersleyen 1994.

5 Temple of Hatshepsut at Deir el-Bahari; Theban tombs 110, 131 (temp. Tuthmosis III). For publications of Theban tombs see Porter and Moss 1960/1970.

6 Theban tombs 78, 74, 201 (temp. Tutthmosis IV - Amenophis III).

7 Manniche 1978.

8 Manniche 2010, 17-18.

9 *Cf.* the representations in the rooms of the High Gate at Medinet Habu of Ramesses III: Medinet Habu VIII, 1969, pls. 630-657.

10 Manniche, 1991, ch. 6. Only in one previous instance is the barrel-shaped drum present in a banquet ensemble: in a tomb now lost, the wall-decoration being copied by an early traveller at an unspecified location, but probably at Thebes. The portable boat-shaped harp in the top register dates the scene to no later than the reign of Amenophis III, just before the Karnak relief of Amenophis IV/Akhenaten: Manniche 1991, fig. 31 (from Dümichen 1869, pl. XL B).

11 Hickmann 1949, 110, pl. 79; Hickmann 1951.

12 First represented under Tuthmosis III in banquet ensembles in Theban tombs 22, 100, 241, 129; 95 (temp. Amenophis II - Tuthmosis IV, now destroyed); 7, and the tomb of Nebamun now in the British Museum: Parkinson 2008, fig. 83 (lower right); also in chapel 11 at Gebel Silsile (temp. Amenophis II).

13 Manniche 1988, 64-68, fig. 14.

14 Priese 1991, no. 146.

15 Smith and Redford 1976, pl. 43.

16 Hamburg 1965, no. 38 (now in the Metropolitan Museum of Art, New York); 61 (= Berlin 1967, no. 761); 62 (= Berlin 1967, no. 760), 63 (= Berlin 1967, no. 759); *Annales du Service des Antiquités égyptiennes* 39, pl. 138.

17 Davies 1905-08 I, pls. 9, 13; II, pl. 18; III, pl. 15; VI, pls. 5, 18, 20.

18 Terrace and Fischer 1979, 145-148 (called 19th dynasty).

19 TT 40: Davies and Gardiner 1926, pl. 15; TT 49 (temp. Ay) greeting tomb-owner (not king) Davies 1933, pls. 17, 18.

20 Cooney 1965, no. 49.

21 Malaise 1990, 682 - 684.

22 chair: Desroches Noblecourt 1967, no. 11.

23 Malaise 1990, 699-701.

24 *Kheruef* 1980, pls. 24, 40.

25 cf. Bietak 1985.

26 Theban Tomb 273: Manniche 1975, fig. 21; Turin stela with Nebethetepet mentioned below; cf. also the 'larger' Dakhla stela, now in the Ashmolean Museum, Oxford (temp. Sheshonk II): Gardiner 1919, 19ff.

27 Theban tomb 51 (temp. Sethos I): Davies 1927, pl. 13; 23 (temp. Mernptah): Manniche 1974, fig. 2.

28 Robins 1993, fig. 50.

29 Vandier 1965; Altenmüller 1976, kol. 940: Die 'Hand des Atum', in der Perserzeit als Phallusumschliesserin dargestellt, gilt bereits seit 1. Zwzt als selbst ändigeweibliche Gottheit und wird seit T III als Hathor-Nebet-hetepet, als Hathor oder Neber-Hetepet oder als Juêsaaês bezeichnet. Sie ist die 'Gotteshand', die im NR verschiedenen solaren Gottheiten zugeordnet werden kann und in der SpZt an Isis und Mut assimiliert wird. Ihr Fest wird am 11.IX gefeiert. For the role of Hathor cf. also Manniche 2010.

30 Manniche 1973.

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MUSIC IN THE SYRIAN CITY OF EBLA IN THE LATE THIRD MILLENNIUM B.C.*

Theo J.H. Krispijn

Landscapes:

Syria forms the north-western part of the Fertile Crescent, a bridge between Egypt and Babylonia. Syria is especially interesting for archaeo-musicologists, since a growing amount of material, textual as well as iconographic, has come from recent successful excavations. From the archives of Ebla and Mari we get a reasonably complete picture of musical instruments and musical practice in the late third millennium and the early second millennium. What we know from Ebla and Mari sources can help us to reconstruct the musical world of Syria, which formed the origin of many musical instruments imported into Egypt before and after the Hyksos kings.

When we look at the map of the Ancient Near East, it is obvious that Syria had to be divided into two regions: the Syro-Palestinian coast (the so-called Levant) and the Syrian hinterland dominated by the Orontes river, the Euphrates and its tributaries, the Balih and the Habur. The Euphrates provides the main route to Southern Mesopotamia, so that Syria is open to the East.

The situation in the West is somewhat different. Mountains not far from the coast form a natural border and make the coastal area, the northern Levant, different in character from the Syrian plains behind the mountains. The Levant has always been open to the West, receiving early visitors from Anatolia, Egypt, Cyprus and even from Greece. The most important centre in the northern part of the Levant was the city-state of Ugarit.

One of the most natural ways to enter the Syrian plain from the coast is through the Gate of Homs. Ancient Byblos, the city at the very beginning of the Gate of Homs, was guarding this 'gate'. That was the reason why Egypt used Byblos as a stronghold to maintain contact with the Syrian plain. Through the Gate one could reach important cities such as Qadesh, Qatna, Hama, Ebla, and Alalah.

Music in Ebla (± 2300 B.C.)

Paolo Matthiae, director of the excavation team of the University of Rome at Tell Mardikh, started digging in the middle of the sixties of the 20th century. Soon it became clear that he had found the ancient city of Ebla. Although Matthiae had reached the monumental royal palace on the Acropolis already in the early campaigns, it was a great surprise after ten years, in 1975, that the excavators found a large royal archive in a small room near the courtyard of Palace G. About 20000 tablets and fragments were found in this room, being the remains of administrative, scholarly, and literary archives stored on shelves. Only a small proportion appeared to be literary. The bulk concerned the administration of the royal palace. Most texts carefully recorded the administration of the annual royal gifts of clothes and silver to provincial rulers and local magistrates.

The texts were written in a local dialect of Akkadian, *i.e.* the Semitic language of Mesopotamia. This early form of Akkadian used many logograms borrowed from Sumerian, the language of Southern Mesopotamia, used in the scribal schools all over Mesopotamia and Syria. The scribes were apparently proficient bilingually, both in Akkadian and Sumerian. That must have been the reason that so many lexical texts, sign lists and vocabularies, have been found in Ebla. These vocabularies show strong links with the Mesopotamian lexical tradition, for the most part originating from Uruk in Southern Mesopotamia.

The palace of Ebla must have been built around 2300 B.C. and destroyed by Naram-Suen king

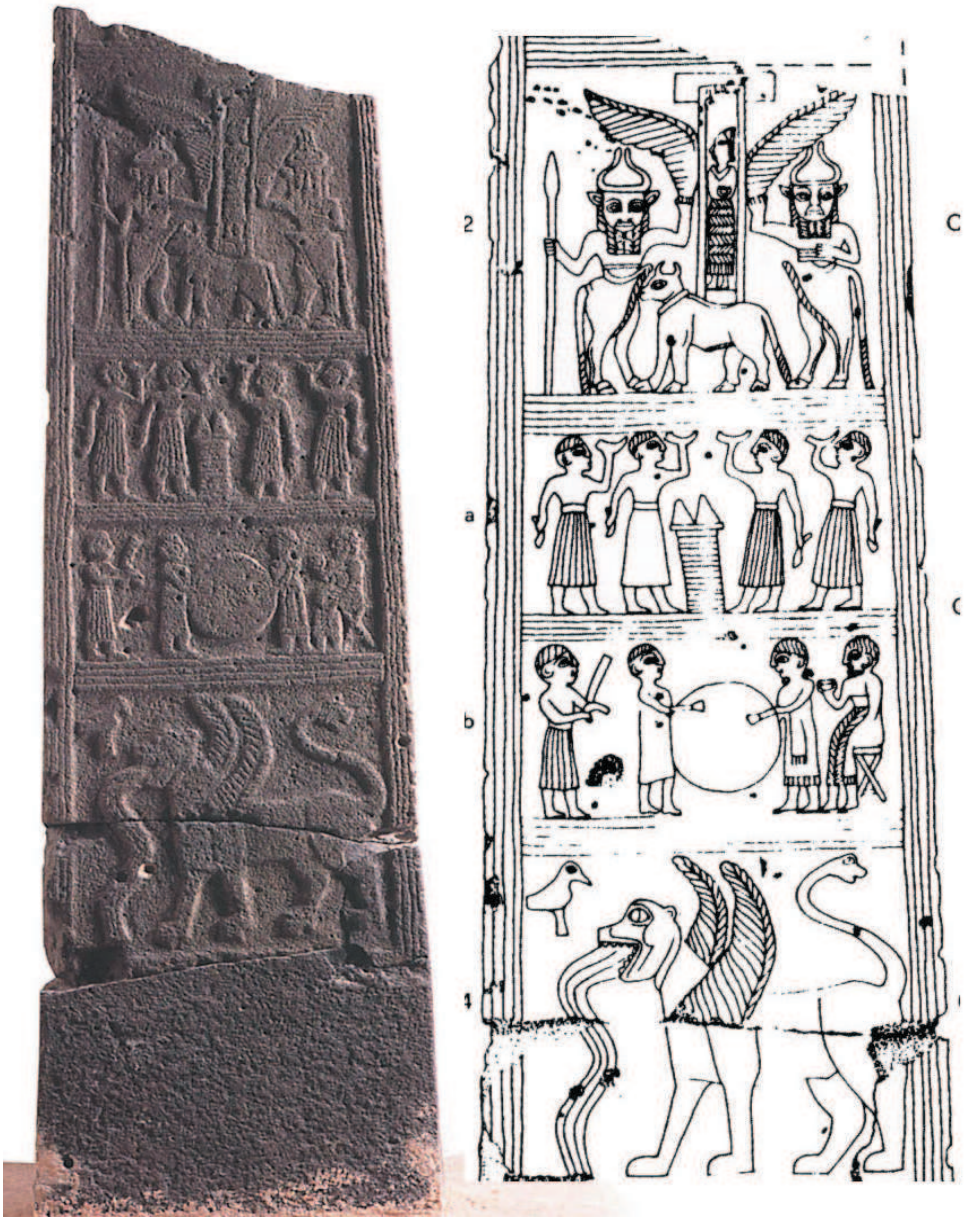
* I am much indebted to Mervyn E. Richardson for improving the English of this paper and for some valuable suggestions concerning the paper itself.

of Akkade ± 2250 B. C. The fire in the palace was apparently the reason why the wall collapsed and fell on to the archive room.

The Ebla texts contain many references to other cities, mostly nearby, but also as far as Kiš in Northern Babylonia. Most prominent were the contacts with Mari, Emar, and Nagar (Tell Brak), the bridge to the northern parts of Mesopotamia, which stood under the growing influence of Hurrian speaking populations. Some documents record conflicts between Ebla and Mari.

Musical instruments and musicians in Ebla iconography

A stele from Ebla dating from the early second millennium is one of few objects excavated in Ebla, which can certainly be linked with music.[1] The other objects mentioned by Biga (La Musique à Ebla) are a bronze rattle and a relief decorated basin, which most likely depicts a cultic scene rather than a musical one. On the stele we can see a musical ensemble in the third register, with two drum players and another percussionist clapping



sticks, apparently accompanying a drinking scene with the ritual depicted above it. Comparable scenes are attested on the monuments from Southern Mesopotamia with a drum and clapping sticks. (Cf. Rashid, S.A., Musikgeschichte in Bildern Mesopotamian, Leipzig, 1984, Abb. 30.) The well-known animal orchestra consists of players clapping sticks in combination with a harp. In the later Syrian iconographic tradition we also find a cultic scene accompanied by a big drum, although one that is clearly smaller than those in Southern Mesopotamia.[2]

Textual sources on musical practice

The administrative texts are the main evidence for music at Ebla. We meet several terms for musicians in these texts which associate them with certain instruments.[3] The general terms are nar 'musician, singer' with its female equivalent nar. munus 'female musician, singer' and nar.mah 'chief musician'. Stringed instruments are played by the BALAĜ.DI (dubdu) 'harp player, tenor, wailer', which is used as a logogram for *nāṭilum*. The *munabbitum* 'female wailer' (Tonietti, Musicians, p. 84) sings with the female eme.bal 'choir singer' (Mari: *muštawûm* ?), with lú.balaĝ 'the man of the (stringed) instrument or the Syrian lyre', and with NAR.BALAĜ = tigi 'big lyre (player)'. Players of wind instruments include lú.gi.di 'the oboe player' and si 'the horn (player)'. Dancing or acrobatics were performed by the hub_2 'the dancer with clapping sticks' and the ne.di 'dancer'.

Local lexical tradition on musical instruments and musicians in Ebla

The Ebla scribes developed a long bilingual vocabulary, known as $eš_2$.bar.UNKEN 'oracle' (later Sumerian eš.bar.kiĝ), according to the incipit, but more generally as 'Vocabulary of Ebla' ('Vocabulario di Ebla' VE) by Pettinato in MEE 4 (Pettinato, G., *Testi lessicali bilingui della biblioteca L. 2769, (MEE 4)*, (Napoli, 1982). These vocabularies were developed on the basis of the 'Early Dynastic Practical Vocabularies' (EDPV) such as EDPV-A.[4] Several bilingual practical vocabularies existed beside the 'Vocabulary of Ebla'. Such practical vocabularies were described as 'Abstracts of the vocabulary' ('Estratti di Vocabulari' EV) by the original editor Pettinato (MEE 4). These lexical lists, which supply Sumerian words with an Ebla-Akkadian translation, contain the following terms for musicians and musical instruments. balaĝ: There are three equations of balaĝ*: = gi-na-lum rúm/ru_{12}-um *kinnārum* 'Syrian lyre' VE 572; = - **balaggum* (?) 'stringed instument (in general), type of song' VE 1242; ^{ĝiš}balaĝ = *zu-mu-ba-*ru_{12} **zumbārum* 'Anatolian lyre'(?) VE 364. The first entry translates balaĝ with *kinnārum*, which occurs in the peripheral Akkadian of Mari (Old Babylonian) and Ugarit (Middle-Babylonian). Ugaritic *knr* and Hebrew *kinnōr* 'lyre' are cognate. Since it is attested only in the peripheral Syrian Akkadian, it must refer to a typical Syrian instrument. That is why it is translated here as 'Syrian lyre'. The second entry gives no translation. That could mean that the Sumerian word is taken over as the loanword *balaggum* in Ebla-Akkadian as it is in Mesopotamian Akkadian from the Sargonic period onwards, with ĝiš in ^{ĝiš}BALAĜ, apparently a distinguishing determinative sign, separating balaĝ =**kinnārum* from ^{ĝiš}balaĝ = **zumbārum*. The word *zumbarum* does not occur in Akkadian. The consonant cluster */mb/* points to a loanword from a Non-Semitic language. I tentatively suggest that *zumbarum* is a dialectal variant of the original Hattic word *zinar/zannarum* 'Anatolian lyre'.[5] M. Civil discusses the different types of balaĝ in his publication of The Early Dynastic Practical Vocabulari A (Civil, M., *The Lexical Texts in the Schøyen Collection CUSAS* Volume 12 (Bethesda, 2010), pp. 99-101)

BALAĜ.DI = *na-ti-lu-um *nāṭilum* 'lifting (his voice)' *i.e.* tenor, wailer' VE 571 is discussed by Fronzaroli (Miscellanea 3, p. 160), who connects it with Hebrew *nṭl* 'to lift'. It must be an equivalent of Akkadian *ṣārihum* 'wailer', which is the translation of BALAG.DI in Mesopotamia. There is no gala 'lamentation singer' attested in Ebla, so BALAĜ. DI = *nāṭilum* could have been the local term for it. BALAĜ.DI // *naṭālum* 'to lament' occurs also as a verb in a ritual context in ARET XI N° 2 (66) // 1 (63) (Tonietti, Musicians, p. 85). eme.bal = *a-*bi_2*-lu-um, a-ba-(lu)-um, da-da-*bi_2*-lu *āpilum, *apālum, *tātappilum* 'answering, to answer, to answer continuously' = 'to sing the antiphone' VE 179 is mentioned together with the *munabbitum* in ritual texts and (Tonietti, Musicians, p. 84 and Archi, A., 'Jewels for the ladies of Ebla', *ZA 92* (2002), pp. 184-186).

gi.di has two translations: *ra-ḫa-lu* gi **raḫālu qanîm*, 'to play (?) a reed (instrument)' *i.e.* 'oboe' VE 1390[6] and *ba-ri$_2$-um *pari'um* 'split reed' EV d 36; g 7. Civil (Practical Vocabulary A, p. 100) connects *raḫālum* with Arabic *a/urghūl* 'double pipe'. In light of this equation it is attractive to combine it with ugula.nar = *ir$_3$-e$_2$/ir$_3$-e$_2$-[um] *irḥalum*, pronounced /*irḥayum*/, 'leader of the singers' VE 957, although it has pharyngal *ḥ* in stead of velar *ḫ*. The other equation **pari'um* 'cut through (reed)' might describe the shape of the 'double oboe. gu$_3$. gi.di = *gi-dé *gidi(um)* 'sound of the oboe' VE 218, a loanword from Sumerian, belongs also here. P. Fronzaroli (Miscellanea Eblaitica 1 (Firenze, 1988), pp. 46-47) has convincingly demonstrated that A$_{4\text{-}6}$ II 32" K[A ....] = *na-ba-bu$_3$-um *nabābum* 'to pipe', from which *embūbum* 'oboe' is derived, belongs to this entry and not to the preceding one.

gi.tak$_4$ = *zi-gal-[x]-mu *sikallum* (?) a type of flute VE 1230.

ĝiš.tag = NI-*bu$_3$-um *uppum* 'drum' VE 366 beside ĜIŠxTAK$_4$ = *a-sa-ru$_{12}$-ru$_{12}$-(um) *asarrum* 'wooden cylindrical drum' VE 437 (*cf.* Krispijn, ICONEA 2008, p. 150 note 31).

hub$_2$ = - **huppûm* 'dancer with clapping sticks' VE 876. hub$_2$ has no translation in VE 876. That could mean that it is a loanword from Sumerian.[7]

nar = - **nuārum* 'singer, musician' In VE 875 nar has no translation, but a translation with the loanword *nuārum* is very likely. Since Old-Assyrian has the non-contracted form *nuārum*, that does not seem to be a Sumerian word, a loanword from Akkadian into Sumerian is possible.

ne.di = *ma-e$_2$/i$_3$-lu-um *maḥâlum* or **maḥlālum* (?)'dancer' VE 845 is an abbreviation of e.ne.di 'to play, to dance'. *maḥālum* or **maḥlālum* can be connected with Akkadian *mēlulum* 'to play, to dance' and Hebrew *māḥōl* 'line dancing' (Fronzaroli, P., *Miscellanea Eblaitica 3, Quaderni di Semitistica* 17 (Firenze, 1990), 201-203).

ru.ru = *mar-ba-a *marba^c(um)* 'two clapping-sticks (forming a square ?)' VE 414. *marba^{c}um* can be connected with Akkadian *rubbûm* 'to quadruple'. The clapping-sticks sometimes form a square, when clapped together (Rashid, S.A., *Musikgeschichte in Bildern Band II, Lief. 2: Mesopotamien* (Leipzig, 1984), p. 49 N° 15 and Durand, J.M., 'Des saltimbanques', in Ziegler, N. (ed.), *La musique au Proche Orient ancien Dossier Archéologie et sciences des origines* no. 370 (2006), p. 47).

si = - **qarnum* 'horn' (VE 1122) can be used as a musical instrument.

za$_3$.me = *wa-ti-um *wadium* 'praised, song of praise' (VE 1181) is originally a type of lyre, Akkadian *sammû*.

It is obvious that so many words for musical instruments and musicians were incorporated into these local lexical lists; only NAR.BALAĜ = tigi 'big lyre' is missing. Musicians include singers (nar 'singer', *munabbitum* 'female wailer', BALAĜ. DI = *nāṭilum* 'tenor, wailer', eme.bal= *āpilum* 'choir member, antiphone singer'), string players (balaĝ= *kinnārum* (*balaggum*) 'Syrian lyre', ^{ĝiš}balaĝ = *zumbārum* 'Anatolian lyre', NAR.BALAĜ = tigi 'big lyre'), wind players (gi.di 'double oboe', si 'horn'), and dancers (ne.di = *maḥālum* or *maḥlālum* 'dancer', ḫub$_2$ 'dancer with clapping-sticks').

The Early dynastic lexical tradition concerning music in Ebla

The Mesopotamian lexical tradition started in about 3200 B.C. in Uruk in level IVa of the Eanna temple complex (Uruk IVa), but many lexical series were standardized only in about 3000 B.C. (Uruk III). In the Early dynastic period this lexical tradition was handed down and expanded by new series. Especially in Fara, ancient Šuruppak, and Abu Ṣālābīkh, a large collection of lexical materials was found. Ebla took over many Early Dynastic lexical series. These contain several terms for musicians and musical instruments, some of which we also find in the local developed lexical series, but others are restricted to the Mesopotamian tradition.

When we discuss the musical terms of the Mesopotamian lexical series found in Ebla, which do not occur in the locally developed series or in administrative and ritual texts, we must assume that the scribes knew these terms as words from the lexicon only and that the instruments named were not actually known to them.

One of the oldest lexical series, already found around 3200 B.C. (Uruk IVa), is a list of professions is Early Dynastic lu$_2$ A (EDLuA). Many entries of this series, those for musicians included, start with the logogram GAL meaning 'big, great' in Sumerian. Since this GAL is missing in comparable entries

from other series, a translation 'big one, leader' is not very likely. The sign lu_2 'man' is absent in this series, but frequent in other, mainly later, series on professions. Since GAL was pronounced /gal/ 'big' according to glosses to the Old-Babylonian version of EDLuA[8], I tentatively suggest that GAL means 'adult' (indicating maturity) and not 'big' (indicating rank) and functions as the equivalent of the lu_2 of the other lexical texts.

EDLuA 105-108 (Ebla version 77-80) contain the following musicians: gal.nar '(adult) musician, singer' (105). nar is found in all genres of texts in Ebla. gal.balaĝ '(adult) harp player, wailer' (106) may be an abbreviation of balaĝ.di 'wailer', well attested in Ebla.

gal.šùd '(adult) prayer singer' (107) and gal.zag '(adult) lyre player, singer of hymns' (108). zag/za_3 can be an abbreviation of za_3.me/mi_2 'lyre, song of praise, hymn', which only occurs with the meaning 'praise' in Ebla.

The Early dynastic List of Professions 'Early Dynastic Lú B' (EDlúE) is known from from Ebla sources (Pettinato, G., *Testi lessicali monolingui della biblioteca L. 2769*, (MEE 3) (Napoli, 1981, pp. 27-46). It contains 16 lines (98-113) with musical terms. Several lines known from sources outside Ebla are unfortunately broken in the Ebla version. These lines run partly parallel with lines of another early dynastic lexical series Wordlist B (206-215)[9]. The musical entries of both series are tabulated below.

Comparing the musical instruments of Mari

Tell Hariri, ancient Mari, near the river Euphrates was a flourishing city during the late Early Dynastic and the Old-Babylonian period. The French excavators found large buildings from these periods, containing many objects of art and luxury, some of them imported from Ur in Southern Mesopotamia, Margueron, J.-C., *Mari Métropole de l'Euphrate au III^e^ et au début du II^e^ millénaire av. J.-C.* (Paris, 2004), pp. 297-299). The name of the singer Ur-Nanše is perfect Sumerian and must stem from the city-state of Lagaš in Southern Mesopotamia. His name contains the element Nanše, a goddess which is mainly worshipped in Lagaš. He has had a harp in his hand. There are remains of a second statue of him on which parts of a harp are more clearly visible. This is another proof of the strong ties between Mari and Southern Mesopotamia.

Nele Ziegler has recently published a comprehensive study on the musical culture of Mari (Ziegler, N., *Les musiciens et la musique d'après les archives de Mari,* (Paris, 2007). I have listed the instruments, that she found in the archives in the table below. In the last column I have indicated whether these instruments are found in the Ebla texts.

It is obvious that the list of musical instruments named at Ebla from around 2350 B.C. differs greatly from those named at Mari 550 years later. The EDPV-A and EDLuE take an intermediate position with its connection with Middle (balaĝ. $ma.ri_2$ = *mirītum*) and Southern Mesopotamia (balaĝ. dilmun). Apparently several imported instruments had made their way to Mari from Iran: *parahšitum* and *šebītum/sabītum*. The terms for percussion instruments look different, but we are often not sure which Akkadian word could have been hidden behind an Early Dynastic logogram.

Ebla in the north-western corner of Syria must have been representative of the musical culture of Western Syria at the end of the third millennium B.C. Such a musical culture must have provided one of the sources of the instruments the Egyptians took over just before and during the Hyksos period.

Table 1. Early Dynastic Lú B (EDLuE) 98-113 // Early Dynastic Practical Vocabulary A (EDPVA)[1] 206-215.

al.ḫub$_2$.balaĝ	a musical instrument (?)		EDPV-A 205	-
balaĝ	stringed instrument		EDPV-A 206	VE 364, 572, 1242
balaĝ.di	player of the harp, wailer	EDLuE 98		VE 571
balaĝ.dilmun	(stringed) instrument of Dilmun		EDPV-A 207	-
balaĝ.ma.ri$_2^{ki}$	(stringed) instrument of Mari		EDPV-A 208	-
[za.am]	player of the zamzam percussion instrument	EDLuE 99		-
[x.x]	player of the ?	EDLuE 100		?
[lú.a$_2$.la$_2$]	player of the big drum	EDLuE 101		-[10]
[lú.gi.di]	(player of the) double oboe	EDLuE 102	EDPV-A 209	VE 1390
[lú.gi.TAG]	flute		EDPV-A 210	VE 1230
[lú.GIxTAK$_4$ = ub$_x$]	player of the flute	EDLuE 103		VE 1230
[lú.búr.BALAĜ]	(player of the) a type of harp (?)	EDLuE 104	EDPV-A 211	-
(lú).ĜIŠ x TAK$_4$]	(player of the) wooden drum	EDLuE 105	EDPV-A 212	VE 366
[LAK 387[1].TAK$_4$]	(player of the) drum	EDLuE 106	EDPV-A 213	-
lú.šir$_3$	performer of songs	EDLuE 107		-
lú.ad	humming (?) singer	EDLuE 108		-
lú.SUM.tu	... singer	EDLuE 109		-
šud$_3$ (= SAGxŠU)	prayer singer (?)	EDLuE 110		-
[ama.šud$_3$]	female prayer singer (?)	EDLuE 111		-
[nu.aš$_2$.di]	singer of curses (?)	EDLuE 112		-
[lú.šu.du$_8$.TAK$_4$.LAK 387]	man holding a drum	EDLuE 113		-
ru.ru^{uruda}	metal clapping sticks		EDPV-A 214	VE 414
si.am.si	elephant's tusk		EDPV-A 215	(VE 1122)

Notes to the table[1]:

- It is uncertain whether EDPV-A line 205 al.ḫub$_2$.balaĝ belongs to the section of musical instruments, since most sections start with the most general term, in this case balaĝ (206).
- lú.GIxTAK$_4$ is the EDLuE variant of gi.tag.
- Since šud$_3$, ama.šud$_3$, nu.aš$_2$.di (< lu$_2$.aš$_2$.di?) are placed among terms for musicians, I assume that their activity was also musical. The gesture of praying and singing are largely comparable (Krispijn, forthcoming).
- The stringed instruments of Dilmun and Mari and the bur$_2$.balaĝ, some percussion instruments: za.am, a$_2$.la$_2$, ub$_x$ (TAK$_4$.LAK 387) and the singer section (EDLuE 107-112) are missing in VE.

Table 2. The musical instruments of the Mari-archives compared with those of Ebla

algarsurrûm	horizontal harp with plectrum	-
alûm	big drum	only in EDLuE 101
ḫalḫallatum	drum	cf. ub_x EDPV-A 213
kinnārum	(Syrian) lyre	VE 572
lē'um	'board' a percussion instrument	-
lilissu	kettle drum	-
mirītum	lyre from Mari	only in EDPV-A 208
murumšûm (< mur(um) $ša_4$)	'instrument that produces a droning sound' precious instrument decorated with ivory and gold = giant lyre (?)	-
paraḫšitum	instrument from Parahšum Iran	-
pitnum	general word for stringed instrument	-
sammû	lyre	-
šebītum/sabītum	instrument of Sabûm	-
tigitallum	a type of lute (?)	
tigûm/tigītum	lyre player (male/female)	only in administrative and ritual texts.
urzababītum	type of lyre	-

Notes

1 See Biga, M.J., 'La musique à Ebla', in Ziegler, N. (ed.), *La musique au Proche-Orient ancien Dossier Archéologie et. sciences des origines no 310* février 2006, pp. 24-31.

2 Cf. The relief from Karkemiš (Woolley, *Carchemish II*, (London, 1921), pl. B, 18b)..

3 See Tonietti, M.V., 'Musicians in the Ebla Texts: A Third-Millennium Local Source for Northern Syria', in Pruzsinszky, R. - Shehata, D. (ed.), *Musiker und Tradierung Studien zur Rolle von Musikers bei der Verschriftlichung und Tradierung von Literarischen Werken Wiener Offene Orientalistik* Band 8 (Wien, 2010), pp. 67-93. For the identification of instruments see Krispijn, T.J.H., ICONEA 2008 (London, 2010), 125-150.

4 M. Civil, *The Early Dynastic Practical Vocabulary A (Archaic HAR-ra A) ARES IV*, (Rome, 2008), p. 5.

5 Cf. Akkadian *timbūtum* < Sumerian *budbu* Krispijn, T.J.H., 'Beiträge zur altorientalischen Musikforschung 1 Šulgi und Musik', *Akkadica* 70 (1990), p. 23 footnote 40.

6 The combination with $ša_3$.dar = *la-NI-lu-um/ra-NI-lum raHilum* meaning 'split (of the heart), to be anxious' (?) VE 580 is not plausible (cf. Fronzaroli, Miscellanea 3, p. 163).

7 It is uncertain whether $ḫub_2.ḫub_2$ = *gu_2-du-gu_2-du-wu-um *qudqudûm* 'jumping' EV v 40 is also a professional name. The reduplicated $hub_2.hub_2$ looks to be a loan from Sumerian gu_4.ud.gu_4.ud 'to jump constantly'. Cf. gu_4.ud.gu_4.ud = *ši-taḫ-ḫu-t[u]* 'to jump constantly' Izi G 250.

8 Cf. Green, M., Early Sumerian Tax Collectors, *JCS* 36 (1984), 93-95, and Civil, M., The Lexical Texts in the Schøyen Collection CUSAS Volume 12 (Bethesda, 2010), 193.

9 Complete edition now.

10 This series was designated 'Word list B' in the first publication of this series by Pettinato (G. Pettinato, *Testi lessicali monolingui della biblioteca L. 2769, (MEE 3)*, (Neapoli,1981, pp. 143-155). Later M. Civil used respectively the designations 'Archaic HAR-ra A' and Early Dynastic Practical Vocabulary A (Civil, CUSAS 12, p. 203 footnote 39).

11 a_2.la_2 = *a-ba-lu-um *ḫablum* (?)"rope" VE 573 is another lexeme.

12 M. Civil has discussed lines 205-215 in his commentary on EDPV-A (Civil, ARES IV, pp. 99-102). I have incorporated much of this discussion in my ICONEA 2008 article on pp. 144-148.

PYTHAGORAS, THE ORIGINS OF MUSICAL MODI AND THE DACTYLS

Peter Strauven & Jan M.F. Van Reeth

For some years, we have investigated philosophical, mythological and cosmological concepts underlying theoretical principles in musical theories, both in their Western as in their Eastern forms.[1] One of the most striking theoretical principles, which is consistent in music theory and history is tone organisation.

Elsewhere, we demonstrated, especially, that a modal classification according to the *oktoèchos* system, deep-rooted in the Syriac-Hellenistic context, was not only a major influence in the shaping of Western medieval music theory[2] but that it was also known to Arabian theoreticians.[3] While studying the *oktoèchos* it became clear that this system included cosmological and philosophical concepts having Mesopotamia and Persian origins.[4]

In this contribution, we shall attempt at reconciliating the Graeco-Minoan myth of the δάκτυλοι with the fundamentals of a theory deep-rooted in ancient Pythagoreanism, in the hope of tracing the oldest sources having contributed to musical, mythological, cosmological and religious complex as they appear in the *oktoèchos*.

However, from a methodological point of view, the question concerning the validity of our evidence should be answered: a) How, and to what extent is it possible to find relationships between music and philosophical concepts? b) Does the musical material reflect cosmological considerations, or, vice-versa and c) What do we learn about music theory, for instance when dealing with mythological accounts?

It may be of some interest to discuss these questions for a while, not only to provide a solid starting point for our interpretation of the mythical Dactyls, but also to provide a summary of the system of the *oktoèchos*, making clear how music and philosophy are closely interconnected.

One of the conclusions of our previous research in the *oktoèchos* was that this systematic order was not a simple and practical arrangement of musical materials in the first place. We were able to demonstrate that the system proved to be a balanced and carefully constructed theoretical model, representing philosophical concepts only applied to musical elements.[5]

In Western music theory, the link with the Hellenistic-Syriac roots and its Byzantine intermediate stage, was forgotten by the time the great music theoreticians at the court of Charles the Great were systematising their liturgical repertoire in numerous *antiphonaria*.[6] The theoretical framework of organised modality, using eight tones, (the ecclesiatic tones) served as a guideline in organising the repertoire according to the demands of the liturgical year, and to provide with the right transition between antiphon and verse during psalmody. The Carolingian authorities of music theory at that time were Boethius, Cassiodorus and Isidorus of Sevilla. They are important in the transmission of antique Greek music theory to the West. Even at the beginning of the twentieth century, no one doubted that the formation of the eight ecclesiatic tones was in fact a translation of ancient Greek music theory to the Western Gregorian-chant repertoire.[7]

Boethius and others were adamant that their classification of Western chant repertoire stemmed from the Greek heritage. They attempted at reconciliating practical music with much older theory, without however fully understanding its meaning. This misinterpretation becomes clear from

the terminological confusion that we perceive, in some passages in Boethius's *De institutione musica*, for instance, where he thinks that the Greek words *tonos, tropus and modus* have the same meaning.[8] Similar observations are also found in Regino of Prüm from the 9th/10th A.D.[9] Such difficulties arising in Western attempts to fit a pre-existent musical repertoire into a philosophically inspired order, are tell-tale signs of theoretical concepts ruling over musical attributes.

From the music itself, it is possible to detect extra-musical influences as the Western repertoire was moulded from a philosophical religious framework. This framework was not the consequence of Ancient Greek influences, but rather of concepts which reached the West *via* Byzantine theory.[10] This Eastern connection in itself was rooted in a West-Syriac, Hellenistic complex of philosophical, cosmological ideas.

At this point, it is sufficient to state that pre-existent philosophical ideas shaped the Western modal organisation of the musical material in what we know today as the eight ecclesiastical tones. It is striking that also in the Eastern Christian repertoire, this same practical arrangement of the musical material was inspired by the same philosophical tradition: it is possible to see there influences of Roman, Byzantine, Syrian, Armenian and Georgian chant repertoires.

We have shown elsewhere that the Arabs must have noticed the great similarity between the speculations stemming from their inherited Persian, Sassanian tradition and the Syrian concept of an eight-fold universe, musically expressed by the modi of the *oktoèchos*. It must have appeared to them that Syrian and Persian cosmology and music, as well as the Greek neoplatonic concept of the world, were all proving each other's status. Thus we were able to show that the *oktoèchos* influenced to some extent the shaping of an early Arabian modal system.[11] It may suffice here to point to just one example, illustrating that the eight-fold system of modality can contribute to the generation and development of tuning systems.

The famous court musician Isḥāq al-Mawṣilī (d. 850) is credited to have conceived the first modal system after the rise of Islam.

According to the *Kitāb al-Aghānī*, al-Mawṣilī perfected the modes and the rhythms, and classified them in a way hitherto unknown, 'solely by his own endeavors, and without having known a solitary book of the '"ancients"'.[12] Al-Munağğim (d. 912/913), in his 'Treatise of the modes' *(Kitāb an-nagham)*, also called 'Treatise on Music' *(Risāla fī-l-mūsīqī)*, described the system, that is relating to the frets *(dasātīn)* of the *'ūd* and the fingers used to produce the notes.[13] This system differs greatly from the pre-Islamic system, that of the *ṭunbūr Baghdādī.*

In his 'Great book of music', Al-Fārābī gives a description of this *ṭunbūr Baghdādī* and its tuning.[14] In this system, each string of the long-necked ṭunbūr was divided in no less than 40 equal parts, resulting in a theoretical scale that was already known to the ancient Greeks. It is improbable that this system was the only one used in pre-Islamic times and there are even reasons to doubt that it represented a dominant tradition in the music of the *ğāhiliyya*.[15] However, we mention it here to illustrate that there was indeed a substantial and autonomous Arabian musical tonal organization in pre-Islamic and early Islamic times, however incomplete it may have come down to us. Sharply contrasting to this system, the strings of al-Munağğim's *'ūd* were tuned a fourth apart, with frets placed according Pythagorean interval relations, resulting in a standard Pythagorean diatonic scale, from which eight diatonic modes can be constructed. Those eight modes in turn are divided in two groups of four modes, as is the case in the system of the *oktoèchos*, with its four authentic and four plagal modes.

As we showed, based on Western sources, it is possible that pre-existent philosophical ideas influence the concept of a practical modal organisation. Furthermore, as we explained from an Arabian theoretical stand-point, it is possible that modal systems, based on philosophical ideas in turn influenced basic, practical tuning systems, in this case for the *'ūd*. Having outlined the relation between philosophy in the broadest sense and music theory, represented in the system of the *oktoèchos*, we shall attempt at finding its oldest sources and trace them to the harmonious blacksmith's workplace and Pythagoras.

According to Aristotle, the Pythagoraeans would have thought that the numbers appearing as musical harmonies are forming the basis of all beings:[16] τὸν ὅλον οὐρανὸν ἁρμονία εἶναι καὶ ἀριθμόν.[17]

Aristotle based his theory on the speculations of an Iranian sage, Ostanès, that the Stagirite had met at Athens after the Persian invasion.[18] According to Ostanès, seven spirits represent the seven harmonies of the spheres, the ἁρμονία τῶν ἑπτὰ φθόγγων. In later magic texts influenced by Ostanès, these were often represented with seven sacred and harmonious vocal letters (appearing in different order, *e.g.* αεηιουω). Accompanied by psalmodic singing, they gradually became one of the unpronounceable names of the supreme deity.[19] In this manner, a typical concept of the world could be developed among Greek philosophers: 'Als phonetisches Gebilde (…) bewirkte das Griechische die Vorstellung, daß nicht der Mensch die Dinge benennt, sondern daß die Dinge selbst sich klingend substantiell bekunden. Eine solche Geisteshaltung steht dem Magischen unvergleichlich näher (…). Die Griechen (…) standen auf der Stufe des Ontologischen. In der μουσική ist das Sein, sind die Götter, ist die Religion gegenwärtig.'[20]

Thus a link was established between a seven- or eight-fold cosmology (/soteriology) and music, significantly to be expanded in the Christian elaboration of the *oktoèchos*. Indeed, from the earliest beginnings of philosophy, music theory and ancient cosmology were closely interrelated, an astonishing fact already perspicaciously noticed by Strabo: 'And on this account Plato and even before his time the Pythagoreans, called philosophy music; and they say that the universe is constituted in accordance with harmony, assuming that every form of music is the work of the gods.' [21]

The reference to the Pythagoreans is interesting, because it provides with an indication as to the remotest origins of this tradition. The story about Pythagoras who would have discovered the musical harmonies listening to the sounds produced by a blacksmith hammering his anvil is well known and it has already been remarked that it is practically impossible to calculate the musical intervals by weighing the smith's different hammers, as the story says.[22] Nevertheless, the tradition might have some actual foundation; this is for instance the case for the following part of the story that relates how Pythagoras discovered the proportions of the tonal intervals on the string of a monochord, which he would have calculated and represented by projecting the measurements of the rectangular triangle of the *tetractys* on its hypotenuse.[23]

Pythagoras has remained famous indeed for his genial discovery about the measures of the string and intuitions about their cosmological implications. Yet, the question remains: what to think about the story of the blacksmith? Is it a later invention? or, to the contrary, has it got some underlying historical basis?

Many years ago Eric Werner pointed to another older version of the same story. In that version it is not a real blacksmith, but the mythical smiths of the gods, the Dactyls (δάκτυλοι) in Greek,[24] who likewise would have discovered the same mathematical musical harmonies.[25] Sometimes these are given names referring to their activity, as Ἄκμων, 'anvil',[26] Δαμναμενεύς, 'sledge' and Κέλμις, 'smelter/casting'. Thus, according to Clement of Alexandria, 'Kelmis and Damnameneus, Idæan Dactyli, first discovered iron in Cyprus, <Delos>, another Idæan, discovered the tempering of brass'.[27] Δέλος is at first sight not intelligible,[28] but it might be another form or a misreading of a word with a double lambda, equivallent to δέλλις, being a contracted form of δελφίς: a dolphin, but in this concrete case with the special, technical significance of a *mass of lead shaped like a dolphin*.[29] As this Delos was the one who was responsable for the invention of the alloying of bronze (χαλκοῦ κρᾶσις), one would expect him indeed to have introduced the addition of tin and lead to brass. There are only some occasional allusions to the story of these Dactyls and their involvement with music in ancient sources, but from Strabo and Plutarch one may infer that Hellanicus of Lesbos in his *Phoronis* — a mythological treatise from the end of the 5th century B.C. — developed it from the presentation of the Curetes as ὀρχηστῆρες, contained in Hesiod and in Homer's description of the shield of Achilles.[30]

Werner furthermore pointed to the Lesser Asian origin of the δάκτυλοι, who are appearing in Hittite mythology as dwarfs, artisans and servants of the old Sumerian Mother Goddess *Ku(m)baba*,[31] a deified queen of the third dynasty of Kish (*ca.* 2400 B.C.), identified with the Hurrian *Kebat* and the old Syrian androgyne goddess of fertility *Adamma*. According to Herodotus, there stood in the city of Sardis a temple for the goddess called *Kybebes*.[32] Renamed *matar kubileya*[33] in Hittite texts, she was

revered as *Cybele* in the Phrygian city of Pessinus until classical times, from where she was eventually imported into the Greco-Roman world. A similar Mother Goddess already appears in Minoan Crete, a similarity which points to a common origin, as part of the so-called Egean cultural *koinè* of the late bronze age.[34] Indeed, this Goddess of Syrian origin, often represented naked, appears everywhere in Asia Minor, from the middle of the second millennium B.C. onwards. For example on an Egyptian stèle, this imported Syrian goddess is surrounded by the deities Min and Rešef, thus forming a kind of a triad of gods.[35]

In Hittite representations, the servants of the Great Goddess are not always dwarfs, but clearly are musicians, as is the case[36] with the magnificent and unique statue of Cybele, probably dating from the 7th or 6th century B.C., discovered in the Phrygian gate of the fortress of Büyükkale, where the Hittite palace of Ḫattuša once stood. The statue is now in the museum of Ankara. One of the musicians plays double pipes, while the other plucks a stringed instrument.[37]

Another Lesser Asian form of the Mother Goddess was *Sipylene*, called after her mountain the *Sipylos* near *Magnesia*, revered also with a slight variant of her name as the '*Sibylle*' of *Erythrae*, as Gressmann pointed out.[38] She would be born in *Marpessos*, a place situated on (and linked to) the Ida mountain in Crete. She was therefore equally named the *Sibylla Idaia* and it was this so-called *Great Mother Goddess of the Ida* with the δάκτυλοι as her servants, who would become famous as the fosterers of the new born Zeus.[39] This close relationship between the Phrygian and Cretan goddess[40] and her Dactyls is confirmed over and over again by Strabo in his account about the Ida tradition.[41] Indeed, with an aspect very similar to some Near Eastern representations, Zeus is appearing on the Bronze tympanon from the Idaean Cave (8th century B.C.), apparently surrounded by two winged δάκτυλοι Ἰδαῖοι or Curetes.

In this perspective, we would now like to reformulate our question about Pythagoras: is there a possible link between the legendary philosopher and the δάκτυλοι Ἰδαῖοι? We believe that there is indeed such a connection. According to an old Cretan tradition, Pythagoras would have labelled the spot where the tomb of Zeus was supposed to be located with an inscription.[43] While mentioning this inscription, Porphyry relates of the initiation of Pythagoras into the mysteries of one of the Dactyls, *Morgus*, in the cave of Ida.[44] According to Porphyry's inscription, Pythagoras was purified during the first phase of his initiation with a 'stone from the sky, from a thunderbolt' — ἐκαθάρθη τῇ κεραυνίᾳ λίθῳ. The stones that were used for this purpose were also called *idaei dactyli*;[45] they were a kind of natural glass, stemming from liquidized and congealed sand stemming from the striking of a lightning, thus having the aspect of a glazed finger. It appears that it could be used as a phallic symbol, representing the phallus of the god of the sky: what was performed on Pythagoras here, was clearly a fertility ritual, in view of his spiritual regeneration.

The fact that the Dactyls are related to a thunderbolt is confirmed by a remark in Solinus' *Collectanea* (3th century A.D.), where we read, in his notice about Crete: *studium musicum inde coeptum, cum Idaei dactyli modulos crepitu ac tinnitu aeris deprehensos in versificum ordinem transtulissent.*[47] This statement might perhaps remind us somehow about older, Luwian and Hittite thunder songs.[48] A few lines further, Solinus also notes that Varro saw the tomb of Juppiter, the same that Pythagoras honoured with an inscription according to Porphyry. According to Kern 'ist längst richtig bemerkt worden' that this attribution of music to the Dactyls is only secondary.[49] But in the light of what we just have said about the initiation of Pythagoras, this position becomes untenable. Not only is the link between Pythagoras, the *dactyli* and the tomb of Zeus well established, but Solinus leaves no doubt whatsoever as to the relationship between the Dactyls and the invention of music from the sounds of striking lightning and thunderbolts. This also explains the kind of music they produced, with cymbals, drums, weapons, pipes and shouts.[50]

The Cretan tradition further establishes a relationship between mount Ida and music. Repeatedly Strabo notes that instruments, as well as nymphs associated to these, are 'mountain-ranging' — ὄρεια/οὔρεια.[51]

As the Mother Goddess herself is often identified with mountains, it is as if music is produced

from *within her*, as a sound stemming from the inside of a cosmic mountain. Later in the Christian Syriac tradition, as we have shown elsewhere, this image was greatly developed in accordance to the Mesopotamian and Syrian concept of Paradise. It was believed that the different degrees of the mountain of Paradise corresponded to a particular sound or tone.[52] Therefore, the Pythagorean doctrine about numbers and harmonies must have been derived from similar Levantine cosmological speculations, who identified the gods with stars and numbers.[53]

Now we have all the elements — the interrelations between Pythagoras and the Dactyls, between Mount Ida, Pythagoras and music — in order to answer our question about the possible link between the mythical tradition and music and music theory. But we still need to discover one missing link: is there a direct relation between the *daktyloi* and music?

Strabo offers strange observations. He speaks about the ὀρειβασία, the 'walking (about) on (a) mountain(s)'[54] by the Dactyls; hence, he says, they are called (also?) βητάρμονες, 'harmony walkers':[55] it is as if the steps they take on the slope of a mountain are in some respect related to a musical sequence. What could this possibly mean? Could these 'fingers of the mountain' originally have something to do with music?

Here we have to recall another meaning of the word δάκτυλος, namely that of a certain (linear) measure,[56] which is also used metaphorically for a *metrical foot* (dactyl).[57] Strabo continues with the remark that 'according to some', the Dactyls were the first settlers on the Ida, so that the δάκτυλοι Ἰδαῖοι were indications for the degrees, for 'feet' and 'heads' or summits, on the slope of the mountain.[58] Thus, when Kern remarked: 'Die Zahl der Daktyloi hat offenbar mit dem Namen nichts zu thun',[59] we are not at all convinced that this proposition is correct. According to Pherecydes, there were Dactyls 'to the right' and Dactyls 'to the left'; furthermore, Sophocles was thinking that there were five male ones, so that one may suppose that there were equally five corresponding female also. Could all this not simply mean that the Dactyls are demons related to the fingers and toes on hands and feet? This seems to be confirmed by the fact that according to Apollonius, the mother-goddess, while in labour to deliver her divine child at the Ida grotto, in order to brace herself, clutched the earth with both hands and planted her fingers into the ground.[61] Therefore, the five 'male' δάκτυλοι and the five 'female', moving as they are in two different directions, to the left and to the right, seem to correspond to a man's hands and feet, which are also usually acting together, but always moving in an opposite way, from the right to the left and equally from the left to the right, just as is doing someone who is playing on a keybord-instrument.

Clement of Alexandria is one of the rare authors who links music and Dactyls. In his *Stromata*, we find an interesting passage about the origins of music. In a discourse on learned, wise men in foreign cultures (such as Indian sophists and Jewish prophets) preceeding Greek philosophy, Clement points to a more mythical (μυθικώτερον) tradition to explain that the Dactyls of the Mount Ida invented the — what he calls ῥυθμοί: numbers, letters, melodies, in music. For this reason the Dactyls in music were given their name: 'Some more fabulously say that certain of those called the Idæan Dactyli were the first wise men; to whom are attributed the invention of what are called the Ephesian letters, and of numbers in music. For which reason dactyls in music received their name. And the Idæan Dactyli were Phrygians and Barbarians.'[62] This is a puzzling passage, because at first sight it is not clear what is meant by these 'Ephesian letters' and why they should be connected with music in the same sentence: are they a kind of magic letters? Or do they represent music notational symbols?[63] In another passage, Clement enumerates six of these Ephesian letters:

> 'Androcydes the Pythagorean says the far-famed so-called Ephesian letters were of the class of symbols. For he said that ἄσκιον (shadowless) meant darkness (σκότος), for it has no shadow; and κατάσκιον (shadowy) light, since it casts with its rays the shadow (σκιάν); and λίξ is the earth, according to an ancient appellation; and τετράξ is the year, in reference to the seasons; and δαμναμενεύς is the sun, which overpowers (δαμάζων); and τὰ αἴσια is the true voice. And then the symbol intimates that divine things have been arranged in harmonious order — darkness to light, the sun to the year, and the earth to nature's processes of production of every sort.'

Thus according to this text, we would have: ἄσκιον, κατάσκιον, λίξ, τετράξ, δαμναμενεύς, αἴσια.[64] We should immediately note that the testimony of Clement is linked to Androcydes' interpretation and his etymological, philosophical speculations. Quoting from a manuscript or from memory, he perhaps intentionally distorted the names of the *grammata* he had before him.

These 'letters' often occur in epigraphical texts as magic invocations, and in magic papyri, but in widely varying forms: obviously, people in antiquity did no longer understand them. However, by comparing all these variant forms, we could try to disclose their original meaning.

We already have encountered one of these names: the same Clement calls one of the Dactyls 'δαμναμενεύς'. Would also the other 'Ephesian letters' simply indicate Dactyls, as the text of Clement seems to suggest? More precisely: are they indicated by their function, as in their activities as blacksmiths, as mythical inventors of this sacred art? As we noted already, δαμναμενεύς means a sledge, the *smith's hammer*.[65] One might expect therefore that the other names would similarly indicate tools and labour in a blacksmith's workshop. As a matter of fact, one of the meanings of a ἄσκιον is a *bellow*, used for stirring up the fire of the smithy.[66] In that case, the κατάσκιον most probably indicates the pipe that is introduced under the charcoal of the forge to blow the fire.[67] Λίξ is a stone or *flag-stone* and makes, as far as we can see, no sense. However, our epigraphical sources provide another, interesting form of the name: αἴξ, meaning 'goat'.[68] This immediately reminds of *Amaltheia*, the goat who according to the myth fostered the newborn god Zeus in the Idaean cave. The link with the Dactyls is therefore obvious. If there would be any relation to a smithy, could the αἴξ indicate the raw material, metal-bars that were to be fashioned in the smithy and that in antiquity, to facilitate transportations by carriers, often had the form of the skin of an animal, with four protuberances (legs) at the edge? The introduction of lead and tin is indeed essential to make bronze and as the description of Pythagoras' initiation shows, this was linked to the activity of Morgus, by means of the *idaei dactyli* (τῇ κεραυνίᾳ λίθῳ), for which the αἴξ might also be another word.[69]

Clearly we have here a series of specialised, technical and at the same time mysterious terms of metallurgists, as meteorites symbolise the procedure of extracting a metal from mines and ores.[70] On the other hand, there might be a relationship between the last name, αἴσια, too, as ancient etymologies often linked the word to the verb ἀίσσω,[71] meaning to glance at, to shoot up, which may be indicating the smoke whirling up from the forge. To our list we should now also add the names of the other three we already encountered in Clement: Ἄκμων, 'anvil', Κέλμις, 'Smelter/Casting' and Δέλος 'mass of lead', as well as the *Morgos*, cited by Porphyry, a noun that means a vessel or (wicker) basket.[72] This brings the number of names for our Dactyls up to ten.[73]

Finally we have the τετράξ. It can be defined in the context of music theory, as 'the series of four numbers by means of which — on the grounds of different mathematical correlations — all musical grades can be established.'[74] In the epigraphical sources we find a number of variant forms: τετρακο<c> or τετραγος.[75] The τετράξ seems therefore to be an indication for the magic triangle, the triangle of the *tetraktys*, perhaps originally linked to the music of the Dactyls or blacksmiths. This would direct us to the origin of the epigraphical texts, that appear to be composed in hexametrical form:[76] as such they were probably nothing else than popular songs, by which blacksmiths accompanied their work. Is here to be found once more the relation between Dactyls, smiths and music, for which the texts of Clement are providing such a striking evidence? In fact, the Dactyls or blacksmiths, members of some cultic, more or less secret society of priest-smiths,[77] may well have produced on their anvils a kind of melodies, not so much in accordance to the weight of their hammers and other instruments, as the ancient sources are suggesting, but by battering different anvils on different spots: at their front-side, more to the middle, and so on, accompanying these sounds by their singing.[78]

At this point, we would like to formulate a tentative conclusion. During the cultural *koinè* of the bronze period, when the Phrygian and the Minoan cultures were still united, a cultural society of blacksmiths attached to the sanctuary of the Phrygian and / or Cretan Ida-mountain developed a music theory based and verified on the position of the fingers of a stringed instrument.

They attributed this theory about the fingers to the divine dwarfs, the *daktyloi* whom they also gave cosmological functions. The link, established at a certain moment in tradition, between the melody produced by the blacksmith and the tuning of a stringed instrument, can only be secondary and has to be attributed to Pythagoras or his school. The Dactyls are a mythical elaboration, stemming from practical music making on a stringed instrument, a lyre or monochord. The strings are tuned in certain relations to each other, by way of a mathematical system, representing at the same time a cosmological structure. Furthermore, the meaning of the Greek word δάκτυλος – 'finger' paves the way for the idea that the relation between the *daktyloi* and the Pythagorean tuning system with all its implications, is not so far-sought when we imagine a musician, shortening the string(s) with his *daktyloi*, discovering the mathematical relations and possible harmonies, as once Pythagoras did. Therefore — *pace* Kern, Chantraine, and others — the original meaning of the Δάκτυλοι has to be 'fingers': the mythical dwarfs derived their name from the musician's fingers.

Notes

1 De Harmonie der Sferen en het ontstaan van de muzikale modi, in: *Handelingen der Koninklijke Zuid-Nederlandse Maatschappij voor Taal- en Letterkunde en Geschiedenis* 62, 2008, 95-118; The Oktoèchos in Arab Music Theory: between Philosophy and Musical Praxis, in: *Conference on Ancient Near East Musicology: Musical Traditions in the Middle East, reminiscences of a distant past*, Conference Leiden 10-12 December 2009, forthcoming; The oktoèchos and the function of music in Syriac Liturgy, in: *Proceedings of the 7th World Congress for Syrian Studies*, SEERI 8 - 16. September 2010, Kerala, India, forthcoming.

2 Strauven-Van Reeth, De Harmonie der Sferen 110-115.

3 Strauven-Van Reeth, The Oktoèchos in Arab Music Theory, *passim*.

4 Strauven-Van Reeth, De Harmonie der Sferen 102-104.

5 Strauven-Van Reeth, De Harmonie der Sferen 115 and, from the outset, The Oktoèchos in Arab Music Theory.

6 Gombosi, O., Studien zur Tonartenlehre des Mittelalters, *Acta Musicologica*, 10, 1938, 151; Chailley, J. Le mythe des modes grecs, *Acta Musicologica*, 28, 1954, 144; Cattin, G., *La Monodia nel Medioevo*, (Storia della Musica, 2), Turin, 1979 / 1991, 100; Jeffery, P., The Earliest Oktoechoi: The Role of Jerusalem and Palestine in the Beginnings of Modal Ordening, in: Jeffery, P., (ed.): *The Study of Medival Chant. Paths and Bridges, East and West. In Honor of Kenneth Levy*, Woodbridge 2001, 155-175.

7 Gevaert, F.A., *La Mélopée antique dans le chant de l'église latine*, Gent 1895, p. V: 'Personne aujourd'hui ne doute que les modes et les cantilènes de la liturgie catholique ne soient un reste précieux de l'art antique.'

8 Boethius, *De Institutione musica*, ed. Friedlein, G., *Anicii Manlii Torquati Severini Boetii De institutione arithmetica libri duo: de institutione musica libri quinque. Accedit geometria quae fertur Boetii. E libris manu scriptis*, Leipzig 1867, 314: *modi, quos eosdem tropos vel tonos nominant.*

9 Regino Prumiensis, *De Harmonica Institutione* (Migne, PL 132) 483.

10 Strauven-Van Reeth, De Harmonie der Sferen 110-111.

11 Strauven-Van Rweeth, The Oktoèchos in Arab Music Theory.

12 Farmer, G.H., *A History of Arabian Music: to the XIIIth Century*, London 1973, 59.

13 Farmer, G.H., The Old Arabian Melodic Modes, *JRAS* 1965, 99; Neubauer, E., Al-Ḫalīl, die 'Töne' und die musikalischen Metren, *Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften* 10, 1995/1996, with a German translation of the text of al-Munaǧǧim, pp. 300-317.

14 Abū Naṣr al-Fārābī, *Kitāb al-mūsīqī al-kabīr*, facsimile edition by Neubauer, E., *Publications of the Institute for the history of Arabic-Islamic science* — Series C, 61, Frankfurt am Main 1998, 248-259; Erlanger, R. d', *La Musique arabe 1. Al- Fārābī, Grand Traité de la Musique*, livres I et II, Paris, 1930, 218-225; Beichert, E., Die Wissenschaft der Musik bei al-Fârâbî. Ein Beitrag zur mittelalterlichen Musiktheorie, *Kirchenmusikalisches Jahrbuch* 27, 1932, 37; Wright, O., Die melodischen Modi bei Ibn Sīnā und die Entwicklung der Modalpraxis von Ibn al-Munaǧǧim bis zu Ṣafī al-Dīn al-Urmawī, *Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften* 16, 2005, 277.

15 Wright, O., Ibn al-Munajjim and the Early Arabian Modes, *Galpin Society Journal* 19, 1966, 27-48; esp. 43, 45.

16 Just as Jamblichus, *Vita Pyth.* 162: ἀριθμῷ δέ τε πάντ' ἐπέοικεν, cf. Hani, J., *Le symbolisme du Temple chrétien*, Paris, 1983, 42.

17 Aristot., Met. A: 5, 986a, W. D. Ross, *Aristotle's Metaphysics*, Oxford, 1924 (1988), 1: 145; Zeller, *Philosophie der Griechen*, 463 n. 1; Tricot, *Aristote, la Métaphysique* 1: 42 n. 2.

18 Van Reeth, J.M.F., Âges ou anges ? L'arbre cosmique et les esprits qui gouvernent les champs de l'univers, *Acta Orientalia Belgica*, 23, 2010, 217-218.

19 Preisendanz, K., *Papyri Graecae Magicae* (GZP), Teubner 1931 (1974), 2: 75, 122 (XII 253 & XIII 776) and Id., Ostanes 1616.

20 Georgiades, Th., Musik: *Die Religion in Geschichte und Gegenwart. Handwörterbuch für Theologie und Religionswissenschaft* 4, Tübingen 1960, 1207.

21 Strabo 10: 3.10, 468 (from the translation by Jones, H.L., in the Loeb-edition): διὰ τοῦτο μουσικὴν ἐκάλεσε Πλάτων καὶ ἔτι πρότερον οἱ Πυθαγόρειοι τὴν φιλοσοφίαν, καὶ καθ' ἁρμονίαν τὸν κόσμον συνεστάναι φασί, πᾶν τὸ μουσικὸν εἶδος θεῶν ἔργον ὑπολαμβάνοντες, *cf.* Zeller, *Philosophie der Griechen*, 463 n. 1. Similarly, the Ikhwān al-Ṣafā' speaks about 'philosophers/sages-musicians' (*al-Ǧukamā' al-mūsīqārīyīn*), Shiloah, A., L'Épitre sur la musique des Ikhwān al-Ṣafā', *Revue des Études islamiques* 32, 1965, 161 + n. 163; Wright, O., *Epistles of the Brethren of Purity, On Music. An Arabic Critical Edition and English Translation of EPISTLE 5*, Oxford 2010, 128 (p. 97 of the Arabic text).

22 Gaudentius, *Harm.* 11; Nicom. Ger., Harm.1: 6; Jamblichus, *Vita Pyth.* 26.115; Waerden, B.L. van der, Die Harmonielehre der Pythagoreer, *Hermes* 78/2, 1943, 170; Werner, E., The Conflict between Hellenism and Judaism in the Music of the Early Christian Church, *Hebrew Union College Annual* 20, 1947, 421-422; Münxelhaus, B., *Pythagoras musicus*, Bonn, 1976, 38-39.

23 Jamblichus, *Vita Pyth.* 83 (= DK 58C4): Τετρακτύς· ⍰περ ⍰στιν ⍰ ⍰ρμονία, Zeller, E., *Die Philosophie der Griechen in ihrer geschichtlichen Entwicklung*, Leipzig, 1919-19236 (1963) 1.1: 463; Smits, J.P.H.M., *Plutarchus en de Griekse muziek*, Bilthoven 1970, 11.

24 Plin., *Nat. Hist.* 7: 57.197: *ferrum* <conflare et temperare> *Hesiodus* <monstrasse> *in Creta eos qui vocati sunt Dactyli Idaei;* Forbes, R.J., *Studies in Ancient Technology* 8, Leden 1971, 81; Burkert, W., *Greek Religion: Archaic and Classical*, Oxford 1985, 173.

25 Werner, E., The Origin of the Eight Modes of Music (Octoechos), *Hebrew Union College Annual* 21, 1948, 222; Id., The Oldest Sources of Octave and Octoechos, *Acta Musicologica* 20, 1948, 2.

26 Originally, the word was denoting a meteorite and this was still known to Hesychius; see what we said above about the *idaei dactyli in fingers, thunderbolds*, note 45 and 49, cf. Chantraine, P., *Dictionnaire étymologique de la langue grecque. Histoire des mots,* Paris (1968) 1999, 48: 'l'enclume pouvant être originellement en pierre'; Forbes, *Studies* 132. Visibly the word goes back as a technical term on secular metalurgical knowledge, from its earliest stage. This is another indication for the antiquity of the tradition that we are studying.

27 Transl. Schaff, Ph., ed. (= A. Roberts, J. Donaldson, A. Cleveland Coxe, edd.), *Ante-Nicene Fathers 2. Fathers of the Second Century: Hermas, Tatian, Athenagoras, Theophilus, and Clement of Alexandria*, Grand Rapids 1885 (1999) 317; Clem. Alex., Strom., 1: 16.75 (p. 48-49 — Stählin, O., GCS): Κέλμις τε αὖ καὶ Δαμναμενεὺς οἱ τῶν Ἰδαίων δάκτυλοι πρῶτοι σίδηρον εὗρον ἐν Κύπρῳ, Δέλος δὲ ἄλλος Ἰδαῖος εὗρε χαλκοῦ κρᾶσιν.

28 We added the name in brackets, to Schaff's translation, from Stählin's edition. Its usual significance is, according to Liddell, H.G., Scott, R., *A Greek-English Lexicon*, Oxford 1968[9], 377 (s.v.) the same as δέλεαρ: *bait*, which makes no sense here.

29 Liddell & Scott, *Greek-English Lex.* 378.

30 Σ 494; Hes. fr. 198; Hellan., *Phoronis, ap.* Strabo, *Geogr.* 10: 3.19 - 472; Plut., *De Mus.* 5; Luc., *De saltatione* 13; Nonn., *Dion.* 28: 275; Harrison, J.E., The Kouretes and Zeus Kouros: A Study in Pre-historic Sociology, *British School Annual*, 15, 1908-09, 308-338; Lasserre, F., *Plutarque. De la musique* (Bibliotheca Helvetica Romana) Olten-Lausanne 1954, 16, 113, 135, 156; Carduff, G.A., Daktyloi Idaioi, *DNP* 3, 1997, 281.

31 Werner, Origin 222; Id., Oldest Sources 2, refering to H. Gressmann, *Die orientalischen Religionen im hellenistisch-römischen Zeitalter*, Berlin-Leipzig 1930, 59; Haas, V., *Geschichte der hethitischen Religion* (Handbuch der Orientalistik 1.15) Leiden 1994, 406-408.

32 Herod. 5: 102: ἐν δὲ αὐτῇσι καὶ ἱρὸν ἐπιχωρίης θεοῦ Κυβήβης.

33 Laroche, E., *Kubaba déesse anatolienne, et le problème des origines de Cybèle. Eléments orientaux dans la religion grecque ancienne*, Paris 1960, 113-128; Munn, M., Kybele as Kubaba in a Lydo-Phrygian Context:, in: *Hittites, Greeks and Their Neighbors in Central Anatolia*, Emory University Cross-Cultural Conference — Abstracts, 2004.

34 Gressmann, *Die orientalischen Religionen* 56; Demargne, P., *La Crète dédalique. Etudes sur les origines d'une renaissance* (Bibliothèque des écoles françaises d'Athènes et de Rome 164) Paris 1947, 86 sq., 93, 97; Dietrich, B.C., *The Origins of Greek Religion*, Berlin 1974, 19-25; Schachermeyr, F., *Die minoische Kultur des alten Kreta*, Stuttgart 1979[2], 267; Burkert, W., *Die orientalisierende Epoche in der griechischen Religion und Literatur* (Sitzungsberichte der Heidelberger Akademnie der Wissenschaften, Philos.-hist. Klasse) Heidelberg 1984, 11-12.

35 Haas, *Geschichte der hethitischen Religion* 356-358 (with the ill. 62-64).

36 See also the Hittite relief of Cybele carved in the rock at Mount Sipylos, Manisa — Spil Dağı, Turkey.

37 Bittel, K., Untersuchungen auf Büyükkale, in: K. Bittel (e.a.), Vorläufiger Bericht über die Ausgrabungen in Boğazköy im Jahre 1957, *Mitteilungen der deutschen Orient-Gesellschaft zu Berlin* 91, 1958, 66-69; Haas, *Geschichte der hethitischen Religion* 409, 1027.

38 Strabo, *Geogr.* 10: 3.12 - 469; Gressmann, *Die orientalischen Religionen* 58 (cf. already note 29) ; Eliade, M., *Forgerons et alchimistes*, Paris (1956) 1977[2], 34.

39 Strabo, *Geogr.* 10: 3.7, 11, 19 - 466, 468, 472 (τροφεῖς – καὶ τὸν Δία κουροτροφήσαντας Κουρῆτας ὀνομασθῆναι); Kern, O., Daktyloi, *RE*[2] 4, 1901, 2019; Nilsson, M.P., *Geschichte der griechischen Religion 1. Die Religion Griechenlands bis auf die griechische Weltherrschaft (Handbuch der Altertumswissenschaft* 5.2, 1-2), München 1961-1967[3], 320, 567, 579.

40 Burkert, *Greek Religion* 177 + n. 17-18.

41 Strabo, *Geogr.* 10: 3.7 - 466: προπόλους θεῶν τοὺς Κουρῆτάς φασιν οἱ παραδόντες τὰ Κρητικὰ καὶ τὰ Φρύγια, 10: 3.13, 20 - 469, 472; Kern, Daktyloi 2019, Id., Kabeiros und Kabeiroi, *RE*[2] 20, 1919, 1401; Schwenn, Korybanten, *RE*[2] 22, 1922, 1441, 1444; Gressmann, *Die orientalischen Religionen*, 58-59.

42 Verbruggen, H., *Le Zeus crétois*, Paris 1981, 72, 77-80; Burkert, W., *The Orientalizing Revolution. Near Eastern Influence on Greek Culture in the Early Bronze Age*, Cambridge Massachusetts 1992, 16-17; Carduff, Daktyloi Idaioi 280.

43 Ὧδε θανὼν κεῖται Ζᾶν ὃν Δία κικλήσκουσιν, Porphyrius, *Vita Pyth.* 17; Harrison, J.E., Themis. *A Study of the Social Origins of Greek Religion*, Cambridge 1927[2], 57-58; Verbruggen, *Zeus* 56-60.

44 Rohde, E., Psyche: *Seelencult und Unsterblichkeitsglaube der Griechen,* 2 dln. in 1 vol., Tübingen 1925[9-10], vol.1, 129-130 + n. 1; Nilsson, M.P., *The Minoan-Mycenaean Religion and its Survival in Greek Religion* (Skrifter Utgivna av Kungl. humanistiska vetenskapssamfundet i Lund 9) Lund 1950[2], 578; Faure, P., *Fonction des cavernes crétoises* (École française d'Athènes. Travaux et mémoires 14) Paris 1964, 113-114; Verbruggen, *Zeus* 81-82; Rutherford, W., *Pythagoras. Lover of Wisdom*, Wellingsborough 1984, 32-33. According to Werner (Origin 222; Id., Oldest Sources 2), Porphyry would have stated 'that Pythagoras learned the secret of music from the dactyloi', but in fact, this detail is not to be found in Porphyry's text.

45 Plinius, *Nat. hist.* 27: 170; Porphyr., *Vita Pyth.* 17; I. Lévy, *La légende de Pythagore, de Grèce en Palestine* (Bibliothèque de l'EPHE 250) Paris 1927, 28, 98 n. 2; Verbruggen, *Zeus* 82; Tzavellas-Bonnet, C., Melqart, Bès et l'Héraclès dactyle de Crète, in: E. Gubel & E. Lipiński, *Studia Phoenicia* III. *Phoenicia and its neighbours*, Louvain 1985, 232; Triomphe, R.,

Le lion, la vierge et le miel, Paris 1989, 181 + n. 72; Otto, B., *König Minos und sein Volk. Das Leben im alten Kreta*, Düsseldorf-Zürich 1997, 40. Our interpretation differs from Harrison, *Themis* 56, who considered the thunderbold to be only the weapon of the god of the sky. Kerényi, K., *Der frühe Dionysos* (Universitetet i Oslo — Klassisk Institutt. Eitrem-Forelesninger 2) Oslo 1961, 18, derives a phallic cult in Crete from the name *Pa-re*, 'Phales' in Linear B (KN Sc 247 and 249 from the chamber of the *Chariot Tablets*). Also in Knossos in the 'lodge of the king' before the palace, there were found around twenty *phalli*, probably stemming from a chapel, Kerényi, *Frühe Dionysos* 19.

46 Compare *Triomphe, Lion, vierge et miel* 31. A myth from Thessalonici relates that two Kabiroi brought the phallus of Dionysus in a *cista mystica* to Tyrrhenia, cf. Hemberg, B., *Die Kabiren*, Uppsala 1950, 284; Tzavellas-Bonnet, Melqart 236.

47 Iulius Solinus, C., *Collectanea rerum memorabilium*, ed. Mommsen, Berlin 1895, 11.6, p. 72.

48 F. Starke, *Die Keilschrift-luwische Texte in Umschrift* (Studien zu den Boğazköy-Texten 30) Wiesbaden 1985, 296-300.

49 Kern, Daktyloi 2020. Similarly according to P. Chantraine, *Dictionnaire étymologique de la langue grecque*, Paris 1999, 250; the name of the dactyles as 'génies bienfaisants' would 'très probablement' not be related to the word for fingers, which would be derived from a stem *tek-, meaning 'to touch'.

50 Eur., *Bacch.* 124-129; Strabo, *Geogr.* 10: 3.7, 9 and 16 - 466, 467, 470; Schwenn, Korybanten 1442.

51 Strabo, *Geogr.* 10: 3.16 – 470 (citing Aeschylus) and 10: 3.19 – 471.

52 De Harmonie der Sferen 103-104.

53 Stauder, W., Die Musik der Sumerer, Babylonier und Assyrer, in: *Handbuch der Orientalistik* 1. *Der Nahe und Mittlere Orient*. Erg. Bd 4 *Orientalische Musik*, Leiden 1970, 233.

54 Strabo, *Geogr.* 10: 3.23 – 474. This is certainly also linked to the fact that natural ores of metals were discovered by primitive smiths on mountain-slopes, for example in the beds of rivulets, Forbes, *Studies* 63.

55 Strabo, *Geogr.* 10: 3.21 – 473 (refering to θ 250).

56 Daktylos, A.M.,: DNP 3, 1997, 281.

57 Thus for example Arist., *Nub.* 651; Plato, *Rep.* 400b.

58 Strabo, *Geogr.* 10: 3.22 -473.

59 Kern, Daktyloi 2018.

60 *Schol. Apoll. Rhod.* 1: 1129 — 371; Eliade, *Forgerons* 87; Forbes, *Studies* 81.

61 Apoll. Rhod., *Argonautica* 1: 1130-1131:

Ἀγχιάλη Δικταῖον ἀνὰ σπέος ἀμφοτέρηισι
δραξαμένη γαίης Οἰαξίδος ἐβλάστησε.

62 Transl. Schaff, *Ante-Nicene Fathers* 2: 317; Clem. Alex., *Strom.* 1: 15.73 (p. 46-47 — Stählin, O., GCS): Τινὲς δὲ μυθικώτερον τῶν Ἰδαίων καλουμένων δακτύλων σοφούς τινας πρώτους γενέσθαι λέγουσιν, εἰς οὓς ἥ τε τῶν Ἐφεσίων λεγομένων γραμμάτων καὶ ἡ τῶν κατὰ μουσικὴν εὕρεσις ῥυθμῶν ἀναφέρεται, δι᾽ ἣν αἰτίαν οἱ παρὰ τοῖς μουσικοῖς δάκτυλοι τὴν προσηγορίαν εἰλήφασι. Φρύγες δὲ ἦσαν καὶ βάρβαροι οἱ Ἰδαῖοι δάκτυλοι.

63 Kuhnert, E., Ephesia grammata, *RE*^{2} 5.10, Stuttgart 1905, 2771-2772; S. Michel, *Die Magischen Gemmen. Zu Bildern und Zauberformeln auf geschnittenen Steinen der Antike und Neuzeit*, (Studien aus dem Warburg-Haus 7) Berlin 2004, 11.

64 Transl. Schaff, *Ante-Nicene Fathers* 2: 317; Clem. Alex., Strom. 5: 8.45,2 (p. 356 — O. Stählin, GCS), Kuhnert, Ephesia grammata 2771.

65 The hammer of the smith has often an important religious power, cf. Eliade, *Forgerons* 24; Forbes, *Studies* 76.

66 Liddell & Scott, *Greek-English Lex.* 257 s.v. ἄσκιον: Dim. of ἀσκός (*s.v.* 258): *skin, hide, belly, bellows*; Chantraine, *Dict. étym.* 124-125.

67 Forbes, *Studies* 135.

68 Jordan, D., Ephesia Grammata at Himera, *Zeitschrift für Papyrologie und Epigraphik* 130, 2000, 105-106.

69 Indeed: αἴξ can also indicate a fiery meteor, as in Arist., *Mete.* 341b3, cited Liddell & Scott, *Greek-English Lex.* 40 *s.v.*.

70 Eliade, *Forgerons* 15, 46; Id., *Traité d'histoire des religions*, Paris (1964) 1970, 196-198; Forbes, *Studies* 77-78.

71 Muller, F., *Grieksch woordenboek*, Groningen 1926^{2}, 23.

72 Chantraine, *Dict. étym.* 712.

73 ἄσκιον, κατάσκιον, ἄιξ, δαμναμενεύς, αἴσια, ἄκμων, κέλμις, Δέλος, μόργος, τετράξ.

74 Van der Waerden, Harmonielehre der Pythagoreer 178; Delatte, A., *Études sur la litterature pythagoricienne*, Paris 1915, 249 defines *Tetraktys* as follows: 'Gesamtheit von 4 Zahlen, deren Verhaltnisse die grundlegenden musikalischen Intervalle darstellen.'

75 Jordan, Ephesia Grammata 105-106.

76 Jordan, Ephesia Grammata 106.

77 Eliade, *Forgerons* 82-91; Forbes, *Studies* 73-80.

78 Producing such melodies by battering anvils is indeed very well possible, as we have personally expirienced several times, at the occasion of the yearly feast of Saint Egidius in Antwerp, when the dean of the guild traditionally 'plays' on a series of amstrils.

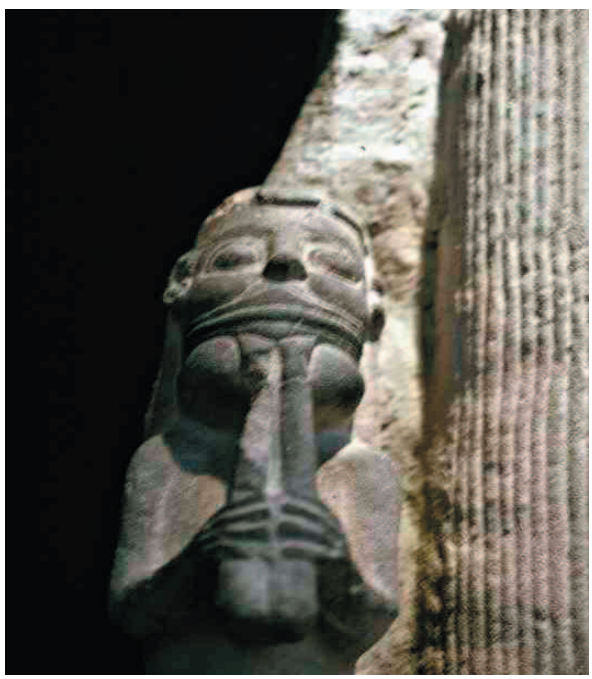


Figure 1. Dwarf playing double pipes, statue of mother-goddess of Büyükkale, at the mseum of Ankara. (see p. 58)

Figure 2. Statue of mother-goddess of Büyükkale at the museum of Ankara. (see p. 58)

EGYPTIAN CONNECTIONS: NARMER INSCRIPTIONS AS SUMERIAN MUSICOLOGY

Ernest G. McClain

Before Greece abstracted a theory of harmony, Egypt embodied its musical mythology in graphic art that remains vibrantly alive to our eyes today. Here is mind-boggling adventure in recovering metaphors and possible origins.

Figure 1a. King Narmer's mace.

Treasures from the past

In 1897-1898 Egyptian archaeology unearthed some of the earliest arithmetic of the ancient Near East. These symbols on the mace head of Narmer (figs.1a-b) sometimes read as Menes, or King Scorpion, perhaps the first pharaoh of a unified Upper and Lower Egypt, presumably celebrating the capture of 400,000 bulls, 1,422,000 goats, and an army of 120,000 men. (fig.1c) Bulls, goats, and men are identified by their depiction.[1]

Figure 1b. Drawing of Narmer's Mace. (after White)

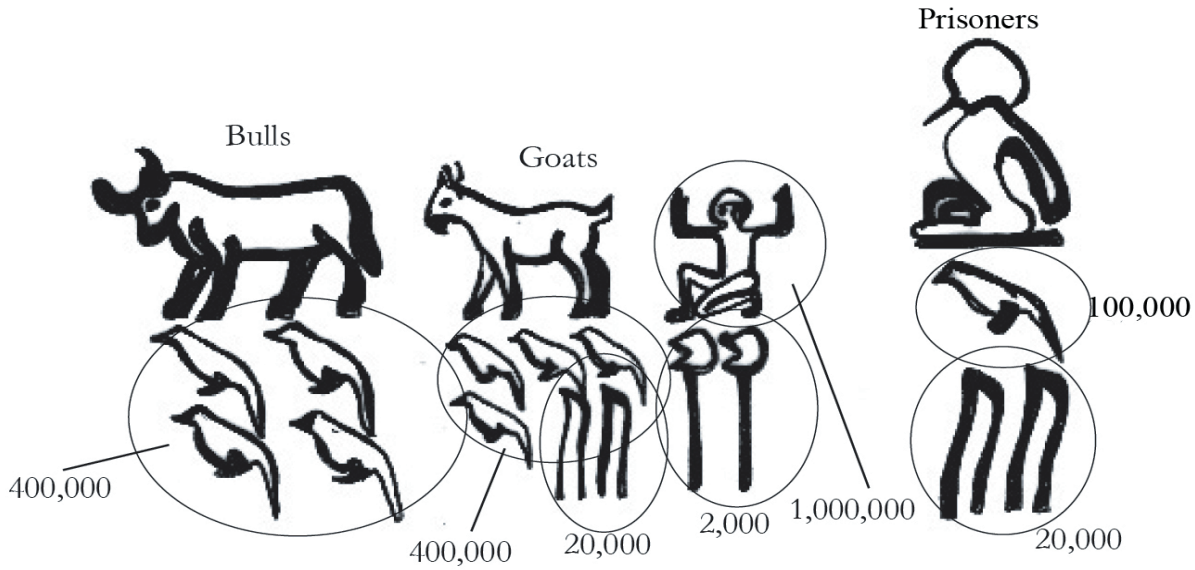


Figure 1c. Counting method.

The numbers below each are indicated by glyphs for an early base 10 arithmetic with seven different symbols for units, tens, hundreds, thousands, myriads, hundred thousands, and millions. Four tadpoles below the bull at the left each indicate 100,000. At the far right, under a bound prisoner (apparently awaiting decapitation like ten others standing tall with severed heads aligned between their feet) another tadpole indicates 100,000 men while two bent human fingers each indicate 10,000 more for a total of 120,000 soldiers being killed. Behind the symbolic goat in the middle a seated man with upright arms indicates 1,000,000 in a posture suggesting awe of Egypt's largest numerical counter (soon discarded); 4 tadpoles add another 400,000 and two bent fingers add 20,000 while two lotus buds below the man indicate another 1,000 each for a grand total of 1,422,000 goats. Georges Ifrah asks whether these are real numbers, or if they are purely imaginary figures the aim of which is to glorify King Narmer, circa 3200 B.C.[2]

Ifrah's own brilliant work in studying the manipulation of numerical tokens (prior to the invention of floating place value and a simpler notation) helped to expose the Sumerian grain pile of 1,152,000 units (published in ICONEA 2008 as an Ur-text in archaeomusicology).[3] That single tablet suffices to integrate all of Narmer's numbers and many other symbols. I abstract what is needed for his story, and append a copy of its matrix for readers interested in more detail. Here, for musicology, I assemble the metaphors I find most felicitous in English without respect to linguistic sources.

A picture worth many thousand words

Sumer's grain pile required notation by 32 counters each worth 36,000 units; The 400,000 bulls of Egypt need only 4 pollywogs. The tonal model for both maps a pentatonic peaceable kingdom of pentatonic graciousness that we all know as a musical paradise for children of any age.

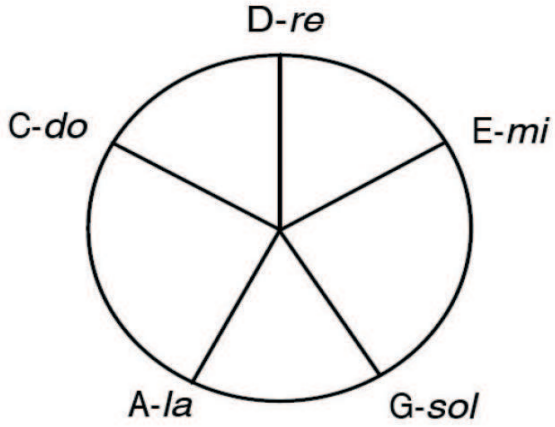


Figure 2. Five-armed humanoid.

This visually provocative early symbol as a five-armed humanoid (fig.2) set within the all-encompassing circle of the sky becomes, from Dynasty V, the Egyptian double glyph for the Underworld where a dead Pharaoh reigns as god;[4] visually it suggests a vector analysis of the scale by a human fiver. Two legs, two arms and a head radiate from a sexless crotch at angles appropriate for singing 'do re mi sol la'. This star glyph is repeated endlessly in other contexts, with variable positions of hands and arms, and decorates the body of sky goddess Nut, arched on fingers and toes over subjects suckling from her breasts.[5] These five are accepted here as mantles of radiance that Sumer assigned to its own deities – the highest of whom eventually were identified by numerical nicknames belonging to Plato's musical science as defined by Narmer's numbers. Here is the planetary subset of his own World Soul – the most seriously studied model of the cosmos ever proposed by the ancients and still useful to Ptolemy and Kepler as we approach modern times. Meet yourself as a human fiver under a tri-morphic deity limited to products of 2, 3, and 5 and who reigns throughout eternity in virtual models in which feet and head alone are Platonic constants – permitting Socrates to discover in Book IV of Plato's Republic that the elusive meaning of Justice has been rolling before our feet the whole time.[6]

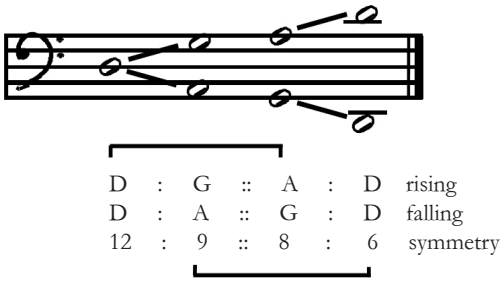


Figure 3. Plato's musical proportions.

His 'musical proportion' 12:9::8:6 (fig.3) quantifies beginning and end as the head at the unambiguous zero hour of 12:00 as cyclic perspective. Equal Temperament ensures that feet at 7:00 and 5:00 are in perfect agreement. We live still with this Egyptian heritage and its Platonic trinity that all major religions share. Leaving hands free to explore other possibilities, it is feet that guard that throne of deity. Sumer pictured this schema as naked Ishtar, the Sumerian Inanna, standing on the backs of two lions lying peacefully head-to-tail under her naked feet, and on each foot we see three giant talons as toes as if belonging to some great bird of prey.[7] Egypt pictures every detail in its own way, with this glyph as supreme sophistication. Meaning was never lost; New Testament Jesus washes the feet of his own disciples (to their consternation), to embed this metaphor in Christology forever, and Homer's great sure-footed chariot horses, some with both minds and voices, are indelible in Greek mythology, inspired by this same arithmetic. Any five consecutive tones in the universal spiral of musical fifths and fourths must be tuned aurally from nearest neighbors, and so I name this pentatonic subset (C G D A E) as if paired from the middle, representing the sun of insight, with pitch class D as center of symmetry, preserving A and G, our first and seventh letters, as Plato's means and first pair of twin sons, named Atlas and Gadirus, as if to anticipate the modern roles of A and G as first and seventh.[8] (fig.4) Here, however, a 9-tone enneatonic tuning from $B^{\flat}$ to $F^{\#}$ emerges as mediator.

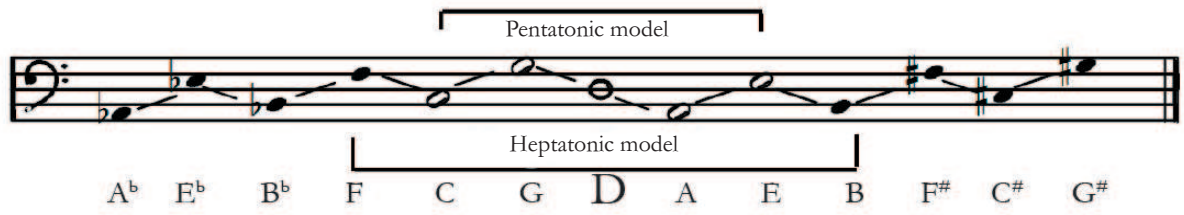


Figure 4. The great Serpent of the spiral of musical 5ths and 4ths.

Figure 5a. Narmer's palette, reverse and obverse, correlate with Dumbrill's line drawing. In the Museum of Cairo. Circa 3100 B.C.

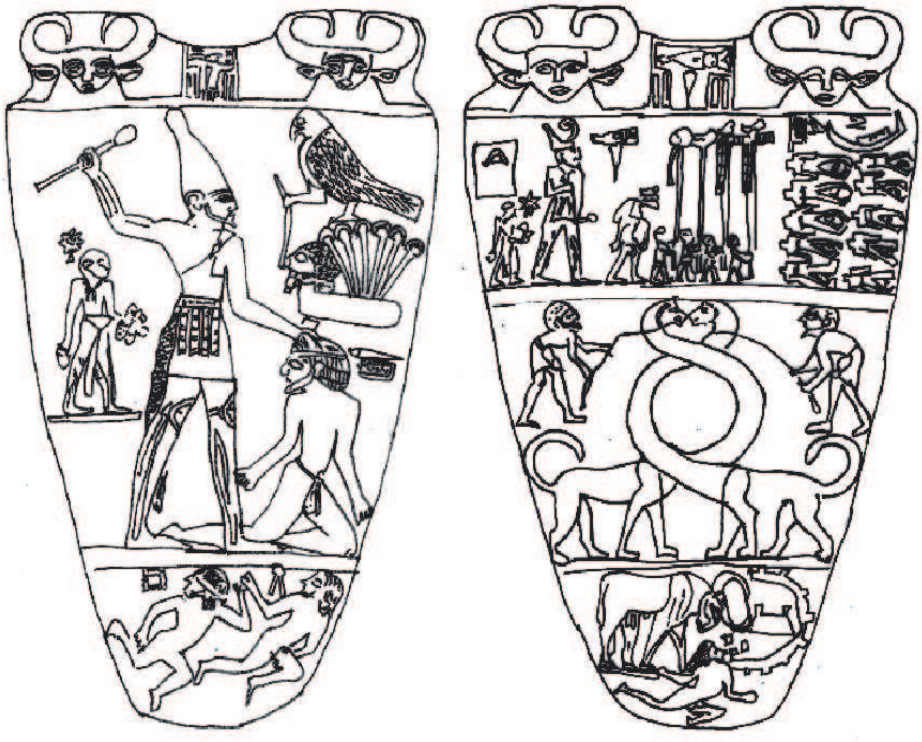


Figure 5b. Narmer's palette, reverse and obverse, Dumbrill's line drawing.

This naming minimalizes and equalizes sharps and flats and proves indifferent to physics, for quantification that defines frequency ratios in one direction naturally defines idealized string and pipe lengths in the other. On Narmer's palette two giant four-footed serpopards confront each other face to face with very elongated necks curled around each other, hovering over a circular depression presumably meant for the preparation of ritual eye paint. (figs.5a-b) Focus on the Great Serpent understood in the metaphor of lion of the ground, for a first intimation of the meaning of strange beasts in Ancient Egypt; eventually we learn to recognize them as ourselves – astonishing both self and other.

Embodiment

To help arouse feeling to its own great responsibility in intellection stand in front of your own clock with feet at 7:00 and 5:00 and hands at 10:00 and 2:00 and be assured that you constitute a vector analysis of the pentatonic model (any five consecutive pitch classes) that modern 12-tone equal temperament equates with 12 hours of demonic regularity. (fig.6) Sumer relieves Egypt of a 13th pitch class. Narmer is 12-tone and the interesting question is how it happens.

Raise your right hand overhead, as if pointing toward Isaiah's location of the throne of heaven, and bring it down in a great arc circling to the right through seven hours to point toward your left foot and thus semaphore seven undefined semi-tone hours as Plato learned (perhaps from 5th century B.C. Philolaus whom he had been accused of plagiarizing. He knew that a teacher needed to transform into wonder what his culture took for granted.) This first position of the musical 5th D:A as 2:3 rising in modern frequency ratios identifies the Ea-creator string of Babylon symbolizing god 40 in its musical pantheon and meaning 40:60 = 2:3. He is the first of Narmer's 400,000 bulls as god 40 leading myriads (ten thousands). Now do the opposite with your left arm to end up crossing the right and poin-ting to the inverse (reciprocal) fifth D:G as 2:3 falling to the left. Your crossed arms embody the glyph for a crossroad leading four ways to civilization. We have mapped Plato's musical proportion 12:9::8:6 without doing any arithmetic. (Serpopard necks are entwined.)

Now, remaining conscious of the four directions (god Marduk's four winds given him to play with at birth, and preserved by our own ears as seat of balance) move each arm separately seven more hours in the same directions to return to the positions C and E of figure 2. Feet map the Greek tonal constants framing tetrachords of 3:4 as perfect fourths awaiting whatever we please to insert, and arms map the cosmic meaning of Egypt's double hieroglyph for heaven in the ratios of Plato's World Soul as a planetary subset of what 12 is. Clocks serve both tone and time with the graciousness of sister muses not yet quarreling over each other's curricular priority. The difference between fourths and fifths vocally is routinely experienced as between small intervals and large intervals associated with physical control of the voice.

In Egypt, the 'Ten Hours of the Night' are goddesses in the underworld of Osiris, protecting the moon-boat from threatening serpents as it carries the sun god, back through the base of a Holy Mountain to arise again between the same twin peaks.[9] Head and feet map Plato's musical proportion as any three consecutive tones in the great Winged Serpent of spiral fifths tuning: they lie automatically at the angles of figure 2. Paired feet locate the head for us and Sumerian Inanna, Ishtar's prototype, as she carefully nurses the broken roots of the tree

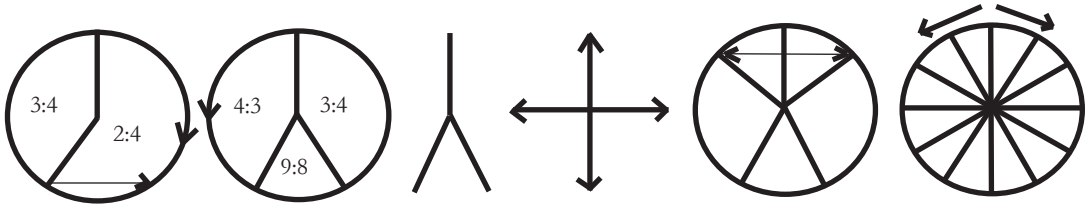


Figure 6. New intervals in Spiral 5ths must be tuned aurally and can be mapped similarly in pairs in either direction as 7 or 5 semitone hours respectful of the four winds that establish cosmic balance. Radial and rectilinear measure are correlated, however stubborn. Celestial convergence means within 30 degrees, intolerable to musicology.

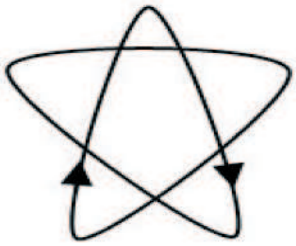


Figure 7.

of life, damaged by the flood, with her feet and not with her hands, to grow into a magnificent tree of life from which Gilgamesh eventually fabricates her bed and moveable chair.[10]

Dance of the semi-tone hours around D at 12:00

7:00	A : G	5:00
2:00	E : C	10:00
9:00	B : F	3:00
4:00	$F^{\#}$:B^{b}	8:00
11:00	$C^{\#}$:E^{b}	1:00
6:00	$G^{\#}$~A^{b}	6:00

Table 1. (contested societal unity)

And each foot sports three giant toes like the talons of a bird of prey. Any five consecutive laterals in the holy mountains displayed here have this pattern veiled within them, and feet are alternate factors of 3 locating the head between themselves. Alternates always enjoy the wholetone ratio of 9:8 to each other as the basic agronomical length ratio in the Ancient Near East. Smaller ratios are normally only left-overs. In retrospect, music maps the cosmos in a way any scribe can reconstruct to the limit of

128				
64				
32	**96**			
16	48	**144**		
8	24	72		
4	12	36	**108**	
2	6	18	54	
1	**3**	**9**	**27**	**81**
C	**G**	**D**	**A**	**E**

Table 2. Double any generator to exceed the bull of 81.

any member within it. One system radiates infinite paths to infinity. A scribe can never be lost.[11] Pantomime this story while you learn it. Share its clocked geometry with a child preparing for kindergarten.

Now learn to draw this Pythagorean symbol in one continuous line starting from 7:00 to 12:00 to 5:00 to imprint good footing on the mind. The pattern completes to twelve tones in six paired steps with the musical proportion of 12:9::8:6 as rotor of eternal time – hiding a trivial but accumulating deficiency that must be discovered by calculation to demonstrate the near-perfection of this pentatonic paradise, so certain to disintegrate with time. Patterns continue through the hours. The five tones of a pentatonic model are defined by four new pitch classes as 3 x 3 x 3 x 3 (take 3 four times, an old Chinese algorithm for 1 - 3 - 9 - 27 - 81) to establish the 2 - digit 81 as sufficiently bullish for pentatonic musicology, East and West. In Egyptian counting board vertical arrays these five could be merely doubled sufficiently to let any one of the first four corral the bull in its own mode, defined by the smallest double that exceeds 81. We can only guess whether others knew the second part of the Chinese algorithm, completed by progressing boustrophedon, as the ox plows, reversing course at the end of a furrow, under the rubric: Add or subtract one-third. This casual indifference in completing quantification naturally exhausts factors of the three in the first column.

Computing the entire spiral 5^{ths} system

Not until an interested scribe discovered a convergence between the 1^{st} and 13^{th} pitch classes (A-flat and G-sharp) could the relative cyclic perfection of pentatonic have been fully appreciated. A Chinese algorithm for tripling leads naturally to Apollo Smintheus as Homer's mouse god nibbling his way toward our Pythagorean comma at 3^{12} = 531,441. Sumerian scribes corralled him by doubling the cornerstone unit to 2^{20} (with Shamash the sun as god 20 who sees everything looking on). This helps to demonstrate how an only slightly smaller just comma of 81:80 provides a suitable 2- digit surrogate in our pentatonic bull. Apollo's nibbling in table 3 is the technology of Egyptian heaven. In the immortal words of Chapter 42 of the Tao Tê Ching he proceeds: The way begot one, And the

1	2	3	4	5	6	7	8	9	10	11	12	13
1 2	3 6	9 18	27 54	81 162	243 486	729 1458	2187 4374	6561 13122	19683 39366	59049 118098	177147 354294	531441
3	9	27	81	243	729	2187	6561	19683	59049	177147	531441	3^{12}or9^{6}

Table 3. Computing triples to the comma at 3^{12} = 531,441 for twelve successive musical fifths.

1; 2; 4; 8; 16; 32; 64; 128; 256; 512; 1,024; 2,048; 4,096; 8,192; 16,384; 32,768; 65,536; 131,072; 262,144; 524,288; 1,048,576

Table 4. Sumer's 20 doublings

one two; then the two begot three, And three all else, meaning (in any language) the ten thousand things.[12] What else could mouse god mean in this arithmetic, adding and subtracting only one part? (He proves to be far-shooter from the end at 2^{12} from which vantage point his reciprocal is immediately the demirugic reference unit itself that 'his arrow reaches instantaneously at 6:00 as viewed from the middle, when Peter as petros symbolizing 729 in Greek eventually is enthroned in Rome'. But much happens before then.)

Half-way to the mis-named Pythagorean comma is its square root of 729 (Plato's cube of 9 with its dialectical double meanings). Suppressing it limits necessary octave doubling to only 2^{18}=262,144 whose square root is 2^{9} as 512 half-way and could be written as 888 in early Christian metaphor for the Savior. The formulas of arithmetical and proportional measure converge coincidentally toward each other to bestow a bag of tricks on scribal adepts - as Jöran Friberg notices in reviewing old evidence and supplying new examples.

Egyptian doubling can be summed to any integer to avoid the intricacy of multiplication and division. Find the largest double within the limit, then add remaining largest doubles to secure the result; if no perfect summation is possible then we are confronted with a continued fraction that can be truncated with a remainder (a trick that explains Narmer's goats that only appear to exceed his bulls). Table 4 displays the resources needed in Narmer's time to frame all necessary bulls, and his various limits necessarily lie somewhere between them. This list surfaces explicitly within a scribal text of 30 doublings from Semitic Old Babylonian Mari destroyed by Hammurabi in 1757 B.C. (A doubling of 9 ten times in an Old Babylonian text displays familiarity with 3^{20} defining the 21st tone in Spiral 5ths tuning.)[13] Iterations produce a log series with periodic coincidences with arithmetical fractions. Another counter means, 'Do it again.'

This Pythagorean comma requires tripling 12 times to 3^{12} = 531,441 to show that leading digits of 53 exceeds those of 2^{19} at 524,288, and so their difference of 7,153 units now must be doubled to the maximum to discover its relative worth. Any interested scribe could have proceeded via the technology of tables 2 and 3 (let's call him Anonymous I, since we know that Pythagoras couldn't prove anything) toward the result in table 5 illustrating the comma as the ratio of about 1/73 – within a digit of 1/72 that determined the 5 holidays of the Egyptian 360-day year. There is simply no way to divorce the sister muses of music, arithmetic, geometry, astronomy, poetry, dance, etc. from their early gracious collaboration that grounds our cultures (until they must fight each other for academic survival today).A plumb line from the throne above maps the tritone square root of 2 in equal temperament at 6:00 o'clock, cutting the model (*i.e.*, the first) wholetone of 9:8 in half as two semi-tones – never computed, and always appearing as remainders from computing consonances. All equal divisions of the octave cycle are naturally irrational roots of the ratio 2:1, but no intervals smaller than 9:8 were actually drawn, and so early musical geometry is merely illustrative, not epistemological; knowing meant knowing the right number. Within wholetones (easily mapped in equal temperament (ET) with a rusty compass in which the radius as half the diameter cuts off semi-tone hours along the circumference, we can approximate by eye the positions of semitone half-hours and quarter-tone quarter-hours (minimal time for observing stellar movement by naked eye astronomy), potentially halved further by metaphorical commas not worth the trouble of defining and often subliminal to ears. Third-tones (unpopular in the West can be approximated by two infixes within the whole-tone.

3^{12}	= 531,441	
2^{19}	= - 524,288	
1	= 7,153	+
2	14,306	
4	28,612	
8	57,224	+
16	114,448	
32	228,896	
64	457,792	+
sum + only	522,169	= 73

Table 5. Computing the comma.

Within the middle third-tone we can approximate the positions of two more infixes to display the blackened comma as about one-ninth of a whole-tone. And in table 2 we notice that a whole-tone of 9 : 8 appears with 9 units between 72 and 81 between D and E. Any scribe might welcome a little bull of 81 as an evasion of the six digits required for the Pythagorean comma (between them we do not aurally notice a difference - it is less than the amount by which we temper musical 5^{ths} and 4^{ths}). No further computation is necessary for musical understanding.

Taming the Serpent as Lion of the Ground

A very different matrix alignment cuts the first paired musical fifths into just major and minor thirds of 4:5 and 5:6 indicated here as A-f-D falling and G-b-D rising, and these new major thirds are smaller than C:E shown in figure 2 by a comma that we can approximate numerically from table 2 as $1/9^{th}$ of the wholetone 81:72. In the chromatic environment of figures 8 and 9 we are in a new aural context, mapped as a winged cartouche in which the serpent as great wing is severed into three parts that are reassembled as its own body with no more than the original five tones in common. New pitches differ only by a comma so that it proves convenient to use the same letter names, but presented in lower case as reminders that in this triadic alignment those in the outer rows lie a comma closer to the middle row. In tuning practice we are taught to find them first in spiral 5^{ths} (that enjoy stronger resonances) and then modify them slightly to the weaker resonances of 5:4. The result is Plato's quantified societal model that we meet in Sumer's base 60 arithmetic that Narmer graphics exploit.

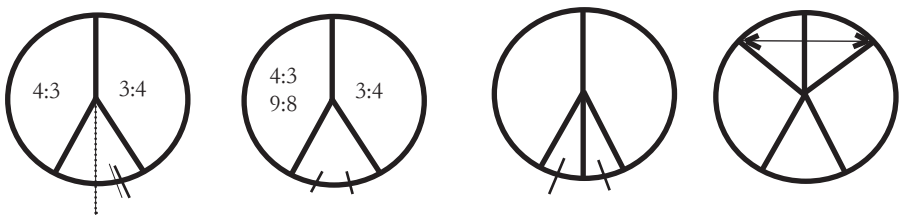


Figure 8.

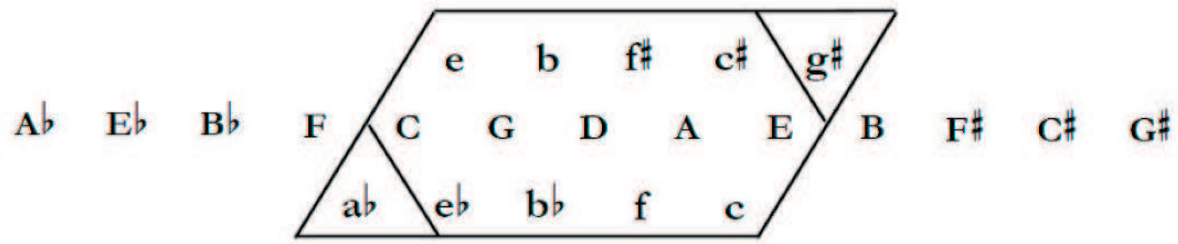


Figure 9. Higher order abstraction of a Just alternative tuning realigned as body of the great hawk watching over the throne of Egypt.

The fifteen elements within the cartouche belong to Ishtar/Inanna, goddess 15, as her bed and moveable chair constructed by Gilgamesh from the restored tree of life that she tended with her feet. In Egypt the farthest corners of the rhomb are cut off to isolate twin sons Horus and Seth, contending from childhood for the future throne; as a consequence the six-sided figure remaining acquires the appearance of a royal cartouche framing a ruler's name. The visual result schematically imitates a flying cartouche within which the king is sometimes pictured as double-faced. In matrix array, tones in the upper row are paired opposites of those in the row below; in Sumer the nearest water is discovered by digging straight down to a semi-tone of 24:25, both left-overs. (This pair are second-level arithmetic and harmonic means within musical fifths of 2:3.) This new Just tuning correlates three slightly different parallel spirals with an intricate new internal symmetry. The new tritones in the corners are indistinguishable aurally from the 'Spiral Fifth' tritones (capitalized), but in opposite ways (a^b with $G^\#$ and $g^\#$ with A^b), and the new just tritones (lower case) lie slightly closer to the square root of 2 in the middle to justify suppressing the Pythagorean tritones altogether. Plato's 3 fixed means in the middle now alternately function also as major and minor triadic thirds; G, D and A are potential members of six different triads. Rows 1 and 2 together (and also 2 and 3) are now intertwined as two small serpents (protruding from the two crowns of Upper and Lower Egypt), unified by a common calendar. The more carefully we look at Narmer's arithmetic the more interesting his paired giant Serpopards become.

Plato's arithmetic for the Egyptian calendar

Narmer's numbers must be read with Egyptian technology, and so I do it with Plato's examples in mind, trusting Ptolemy's assertion, in the second century A.D., that music still was understood as metaphor for ratio theory performed with integers and by manipulating only one integral part (as if using unit fractions of one-half, one-third, one-fourth etc.). This idea is strongly backed by the *Sectio Canonis*, perhaps composed in Euclid's generation (*ca.* 300 B.C.), by computing the wholetone of 9:8 by first halving a line into 8 parts so that one unit length could be added with the compass as 8+1=9. (Apollo Smintheus takes small bites at a time, but he can also cut the bowstrings of an assaulting army overnight so that it flees at the light of dawn.) But in Republic Plato's formula for his base 60 harmonic theory is presen-ted a century earlier in far more powerful algebraic language as: three multiplied by four and by five, and raised to the fourth power.[14] He has doubled the demiurgic unit from 2 to 4 to reach both 3 and 5 in the Egyptian manner of 4-1=3 and 4+1=5. An authentic reading of Narmer must heed these early constraints, still respected 3,000 years later in Greek musicology.

Plato writes that times of fertility or barrenness of soul and body come when their revolutions complete for each species the circumferences of circles, cycles linked to the calendar of 360 days for which 3, 4, and 5 are divisors. But he has specified in advance that all patterns (everything) suffer dissolutions with time, and his model illustrates it at the 3rd power.

Notice that the model itself (fig.10a) suppresses reciprocals, a mere scribal economy, so that corner values are always factors of successive powers of 60. In L_3 in figure 10c ratios of 5:4 along the ascent from the left (64-80-100-125) fail to double to 2x64 = 128 by only three units in three upward steps, each computed as 4+1 part = 5 to arrive at $5^3 = 125$ where indeed we learn both good and evil (in explicit Bible metaphor about the same model).Triangular order is always predictable from the peak. Major thirds of 5:4 along the ascent / / / / are deficient cube roots of 2.

We accumulate a comma of 81:80 at every upward step. (Notice how the fourth step along the base to 81 in L_4 exceeds the first step upward to 80 in L_3 by one unit. This flaw is exaggerated in figure 11.) We dare not accept this accumulation of commas in a science mapping aural consonances as veils of the temple within the soul.

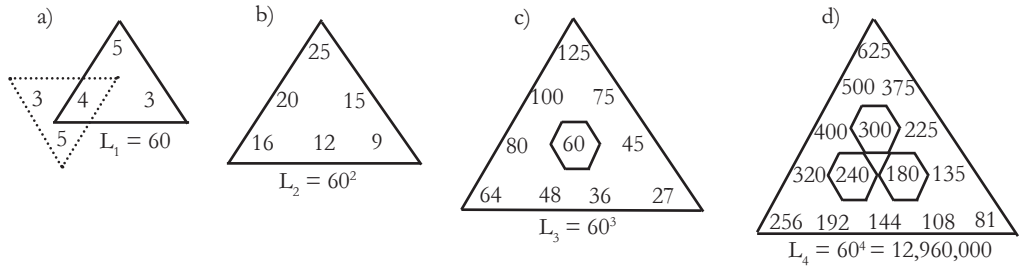


Figure 10. Knowledge of good and evil. Plato assumes reciprocals, and the emergence of insight at the third (cube) dimension as ratios of 4:5 along the ascent /at 64-80-100-125 fail to double to 128, revealing a slight flaw in the World's body (5/4 is the deficient cube root).

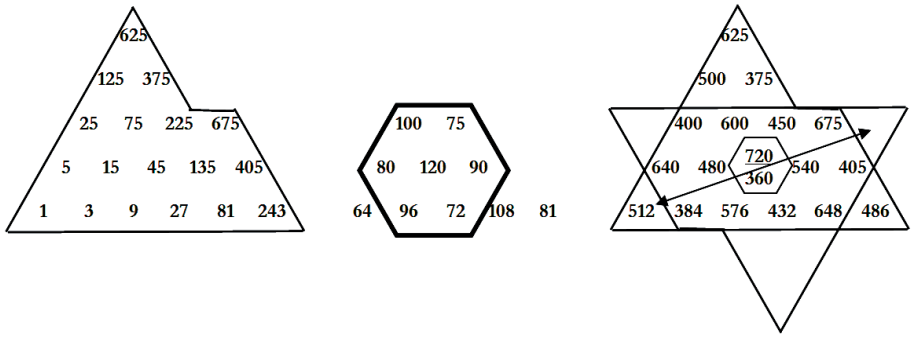


Figure 11. The Egyptian calendar constant of 360 units descends with the Sumerian brick constant of 720 units, so that rotation of the matrix outline exposes paired reciprocals at equal distances on straight lines through the center, and isolating the cornerstone. A new flood (a population explosion) is forestalled biblically by limiting lifetime to 120 years, with Moses as model leader from 80 to 120 years, but with Egypt's pentatonic heaven in his soul. The forgotten cornerstone has no rival as tritone (a-flat or g-sharp, slightly off center).

(The first throne appears at 60 in the second row of L_3; in L_4 three candidates appear at 180, 240, and 300, and 180 is confirmed in figure 11). No more than one step up or down can be permitted from the throne in harmonic mythology although abstract ratio theory otherwise extends to infinity both to the right and upward among powers of 3 and 5. In the completed matrix, ready for realignment into linear scale order, read right to left in every row by the Chinese algorithm, add or subtract one-third. But read left to right by more awkward reversal: add one-half or subtract one-fourth. Read upward along the diagonals / / / / as add one-fourth (or else divide first by 2 to avoid an expression of 8:5). Coming down along the right descent \ is dangerous (5:3 is best avoided, and complicated by shoulders).[15] The mountain protects itself at its borders, as affirmed in the Bible: I will judge you at the borders. Plato abstracts order, then programs connecting canals for his readers.[16] Powers of 2 and 4 that define different doubles also coincide cyclically forever and thus give the cornerstone a prestige as demiurge – clouded, however, by its blindness to consequences. It must provide a factor of 4 for every step upwards, but usually requires further doubling to properly locate the throne. Here is Egyptian Neith, female goddess of creation, Egypt's counterpart to the terrible Tiamat, dragon of the deep in Marduk's Babylon who mothers twenty demonic children (not merely 10 female Hours) to 3^{20} = 3,486,784,401, each requiring ten digits. (Friberg notices the result computed as 9 to the 10th power in Neugebauer's early work, meaning, in tonal application, as ten wholetones early in the 2nd millennium, as origins are computed in reverse!)[17] (The 'Pyramid Texts' which follow Narmer by a few centuries exploit that later arithmetic suggesting that something is mis-dated.)

We cannot escape the permeation of Tenness into everything we touch in harmonics. Watch it grow here. I could not write this without Friberg's perception that empirical scribal shortcuts are deceiving the history of science. Pyramid stories require this Semitic Mari background. The Narmer inscriptions appear to be an amazing compression from 8,640,000,000 that Egypt is both celebrating and parodying. By a coincidence that only deity could arrange, the comma deficiency of 1/125 in ratios of 5:4 can also transform it into a cube root

of 2 by the addition of one part in 100 as 100 + 1/4 + 1/100 = 126/100 (= 63:50) - actually encouraging a base 100 arithmetic that we find at Mari and exploited in Babylon, Plato and the Bible. (63/50 cubes as 1.26 cubes to 2.0003766.)

Here is a trap for the unwary about which Plato did his best to warn posterity but that Platonists, beginning with Boethius, suppressed by dumbing down his model, never publishing correlations of 3 primes. No English text known to me prints figure 10 whose pattern Plato develops with elaborate care and self-conscious pretentiousness as truly a 'Muses' Jest'. He has warned readers earlier that marriages are made in the prime of life, and so figure 11 heeds this warning by developing the calendar limit (what 12 is) as 12 x 60 = 720 days plus nights – laid out first as 1 x 3 x 5 (to avoid octave redundancy), and then corrected by doubling all values to the maximum within the limit of 720. We know this total as factorial 6 meaning 1 x 2 x 3 x 4 x 5 x 6 (transforming most odd males into respectably married men). But notice that its bull on the mountain as largest factor of 5 (always reached by doubling the unit twice before adding one part) is 5^5=625 as in L_4 of figure 10. Interior symmetries always are predictable from the peak (as triangular five in figure 10) but the last three elements on the right belong to the wilderness of ratio theory, meaning that the length of each row must be computed separately when it matters. These favored calendar integers are projected into the tone circle of figure 11, copied from *The Myth of Invariance* that attributed them to India's great creation hymn with lovely Vedic description:

> Twelve spokes, one wheel, navels three.
> Who can comprehend this?
> On it are placed three hundred and sixty like pegs;
> They shake not in the least.
> …….
> O Agni, there stand seven times hundred
> And a score of sons in pairs.[18]
> They shake not in the least.

The pentatonic glyph in solid lines is supplemented by four pairs of Just chromatic symmetries with dashed radials. The forgotten a-symmetric demiurgic cornerstone (512) is the nearest convergence to the square root of 2 in the middle of the octave. This structure integrates Narmer's 400,000 bulls. Notice the Just commas of 81:80 at E:e and C:c, and the a-symmetry of the cornerstone a-flat beyond (but near the square root of 2 at 6:00 o'clock). These three loci are near cube root divisors. Numbers without spokes have reciprocals only within larger limits. But Egypt's pentatonic heaven is everybody's.

All major religions converge on this single comprehensive calendar model – that might have served to help locate celestial events computed with the same base 60 arithmetic. Zodiacal tolerance for convergence was 30 degrees for 12 arc values; commas of 1/9th were easily estimated, and halved further.

The prevailing Babylonian '12-Stars Each' astrolabe published by Waerden[19] is presented here in English transliteration of his base 60 numbers as the prevailing cosmological model of the last two thousands years B.C., with his star data suppressed except for Marduk (M).[20] He proposed the numbers as possible weight measures for a water clock timing 3 double-hour watches day and night, as corrected seasonally in the latitude of Babylon.

The inner circle progresses by fiving from 30 to 60 and back; the middle doubles with ten-ness that he assumed mapped the zodiacal ecliptic, and the outer doubles again with 240:120. These numerical values thus converge with base ten musicology that Mari scribes were expressing in base 60 and in a third notation system on base 100. Whether the model had a practical purpose, however, is speculation; it is intrinsically fascinating in itself and attracted great attention, inspiring many stories. The arithmetic travelled between cultures more easily than verbal metaphors.

Any numerical element limited to factors of 2, 3, and 5 reveals the model to that limit, and this fuels the brilliant allegories of Ezekiel. Rotation to the right maps frequency ratios, and to the left maps their reciprocals (as ancient pipe and string lengths, to which physical application theo-logy is indifferent). Alexandrian authors eventually gave up trying to correct Plato's tonal model to fit newer zodiacal measures. But astronomers Ptolemy and Kepler found it useful, and poets found it inspiring. Modern equal temperament ratios extend outward from the rim in figure 12 as very short spikes, never in perfect agreement with the spokes except at throne 'D' as universal referent. 'Firstborn twins' at A and G determine its place. Related meaning in figure 13 requires consideration.

Mantles of radiance for Sumerian gods as vector analysis of regular numbers in base 60 framed by the Egyptian calendar.

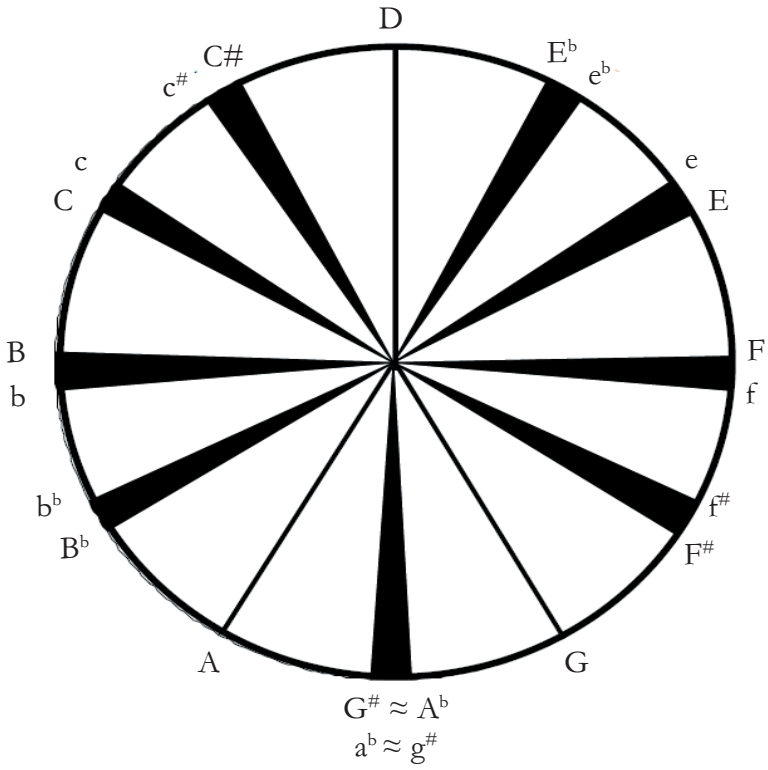


Figure 12. Spiral fifths and Just tunings disagree by a comma embracing the anticipated equal divisions of the ancients somewhere within.

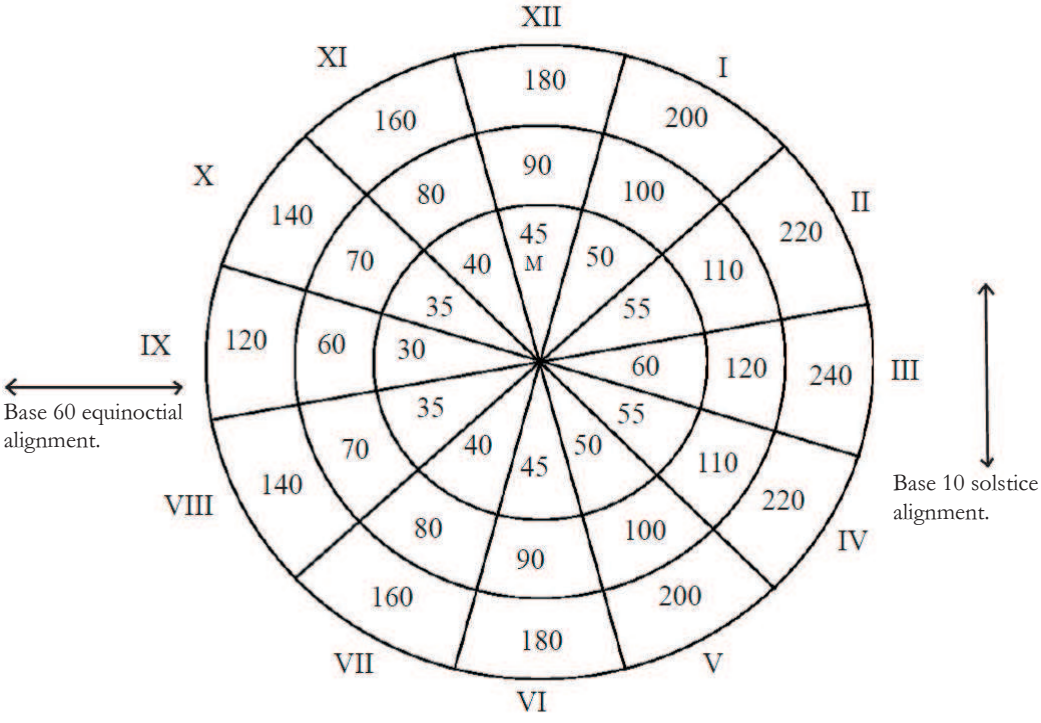


Figure 13, after van der Waerden.

The integration of Upper and Lower Egypt

Narmer's 400,000 bulls are imagined here as led by 'Ea-creator' of Babylon and Sumer as god 40 leading myriads (ten thousands) symbolized by 57 integers of 6 digits each. They frame, however, only seven symmetries (powers of 5) along the ascent, so that the other 50 elements have reciprocals easily mapped by geometric pattern but necessarily computed within some larger limit. As a visual aid to imagination I present the result first in matrix array as products of 3 and 5, indicating future reciprocals with +, and replacing factors with tone-names only where relevant. The matrix itself is ruled by triangular 9 and Narmer is pictured appropriately enthroned above 9 steps defined by 5^8 and with his sandal bearer behind and below – implying that his feet may be properly bared. The central horizontal axis contains 9 tones as the reciprocal meanings of only five integers, while the base displays all twelve tones as foundational in the 'Spiral Fifths' tuning of the great serpent as lion of the ground not only in both Sumer and Egypt but in India, China, and the modern world. The notion of a ground bass in later harmonic theory helps keep the metaphor of ground alive. Here it is the first twelve tones in Spiral 5^{ths} reduced to naked Platonic males of 3 x 5 emanating from 1 that needs modern labeling as zero power.

(In Spell 64 of the Pyramid Texts we encounter this limit within 4,400,000 souls in the Underworld, and many references to millions, and even millions of millions that suggest Narmer's bulls already are severely disciplined.[21])

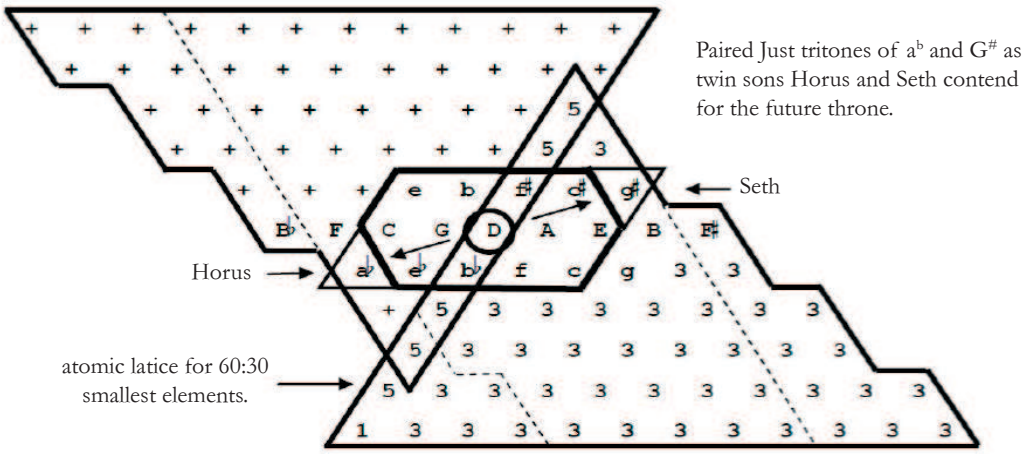
Tables may never have been assembled in this form required for modern analysis. Seth's value as 281,250 among the bulls reduces later to 45:32 within the octave, but that role belongs to Horus in the calendar when its rhomb is limited to 28,800:14,400. In other Narmer matrices both twins appear together so that Seth's ratio is inflated to 64:45 (*i.e.*, as excessive a square root as Horus is defective. I approach cautiously this idea published earlier.[22] Table 8 follows with the completed matrix for120,000 male prisoners as these 48 are studied in close proximity. Results are developed in Egyptian vertical counting board columns more easily, but meaning is seen more elegantly displayed in the hexagonal arrays of Sumer

Reduction to an army of 120,000 lowers each column by one value and exposes the Platonic musical proportion of 12:9::8:6 leading myriads, plus pentatonic and heptatonic scale ratios of 2 and 3 digits each - but not in a functional tonal array centered on the throne, now in row 5.

Realignment in Sumerian brick order facilitates comparison with the union of Upper and Lower Egypt in figure 14. The throne is not centered between the appropriate scale integers. Here a powerful leadership of heptatonic lower classes endangers the throne. (Power would be more wisely centered on the pentatonic leader of only 72,000 doubled to 144,000 and this happens in the Bible among the male choir of Revelation, also based on a pentatonic foundation, revealed by a factor of 9.) This speculative Egyptian reading is supported by another Narmer graphic.

Glance now at the seated man symbolizing 6,000 and connected by a nose-rope held securely by the proud hawk guarding Narmer's throne. The poverty of this matrix when reduced to its naked male factors of 3 x 5 is obvious – promising nothing more than a Trinitarian leadership over the similar pentatonic and heptatonic forces in the 2 rows directly above and below, but now weakened to only one-tenth their previous threat. A surprise, however, follows their doubling as in figure 14.

The eight elements in this smallest matrix framed in base 60 (now rising from the corner) are leaders of hundreds and thousands under the divine leadership of Mesopotamian divinities as gods 30 - 40 - 50 - 60 that felicitously explain the nose-rope held by the guardian hawk. This matrix seems a charming companion for Babylon's nine string lyre, raising questions about the present dating of artifacts and the direction of influence. Their 2-digit leaders belong to the 8 smallest naked males in the lower left corner of figure 14 and table 6. Without their bull on the mountain doubled to 50 the remaining seven (framed heavily in black as Marduk's seat with a back support - Heidel's metaphor, expanded in Plato's figure 11 above) define Plato's true Hellenic mode and the Hebrew mode of the Pentateuch in a just political setting.[23]



Data base for 400.000 as 57 products of 2, 3 and 5.

Figure 14. Proposed musical union of Upper and Lower Egypt.

	1	3	4	4	5	6	7	8	9	10	11	12
9	**390,625**	Bull on the mountain										
8	78,125	**234,375**	Double and add to multiply by 3 to the right									
7	15,625	46,875	**140,625**	Double twice before adding to multiply by 5 upward								
6	**3,125**	9,375	28,125	84,375	**253,125**							
5	625	**1,875**	5,625	16,875	50,625	**151,875**						
4	125	**375**	1,125	3,375	10,125	30,375	91,125	**273,375**				
3	25	75	225	675	2.025	6,075	18,225	54,675	**164,025**			
2	5	15	**45**	135	405	1,215	3,645	10,935	32,805	98,415	**295,245**	
1	1	3	9	27	81	243	729	2,187	6,561	19,683	59,049	**177,147**

Table 6. Factors of 3 and 5 are only male generative integers for 12-tone musicology.

Factors of 3 and 5 are only male generative integers for 12-tone musicology. Doubling to the maximum within the limit confounds appearances to produce a tower of Babel but numbers then can be realigned into naturally increasing or decreasing sequential and cyclic scale order for further display as vectors (mantles of radiance) in a tone circle.

9	390,625											
8	312,500	234,375										
7	250,000	375,000	**281,250**	This ratio value belongs to Seth as scapegoat in narrative.								
6	**400,000**	**300,000**	225,000	337,500	253,125	Single digits 4 and 3 lead hundred thousands						
5	320,000	240,000	360,000	270,000	202,500	303,750	2 digits lead myriads					
4	256,000	384,000	288,000	216,000	324,000	243,000	364,500	273,375	3 digits lead thousands			
3	204,800	307,200	230,400	345,600	259,200	388,800	291,600	218,700	328,050	4 digits lead hundreds		
2	327,680	245,760	368,640	276,480	207,360	311,040	233,280	349,920	262,440	393,660	295,245	
1	262,144	393,216	294,912	221,184	331,776	248,832	373,248	279,936	209,952	314,928	236,196	354,294

Table 7. (These 6-digit 'bulls' were labour intensive and offensive to reason in Egyptian duplatio; few were likely computed.)

8	78,125										
7	62,500	93,750									
6	100,000	75,000	112,500	**84,375**							
5	**80,000**	**120,000**	**90,000**	**67,500**	**101,250**	Tetrachord leaders					
4	64,000	96,000	72,000	108,000	81,000	60,750	91,125	Pentatonic leaders			
3	102,400	76,800	115,200	86,400	64,800	97,200	72,900	109,350	Heptatonic leaders		
2	81,920	61,440	92,160	69,120	103,680	77,760	116,640	87,480	65,610	98,415	
1	65,536	98,304	73,728	110,592	82,944	62,208	93,312	69,983	104,976	78,732	118,098

Table 8. Doubling to the upper limit of 120,000 male prisoners.

(approximated by the white-key octave on E, but shown here in the chromatic notation on 'D' required for more convenient integration with its opposite, our white-key major mode on C). We musicians are held by the same nose-rope at every rehearsal, where tuning problems can become abrasive. (Four optional members lie outside the triangles; the temperament correction of 1/125 is located in peak or pit.)

The distinction between leaders and followers in Sumer become essential to Bible metaphor: Five of you shall give chase to a hundred (men are eligible for the draft at 20), and a hundred of you shall give chase to ten thousand [*i.e.*, magically squared to a higher power]; your enemies shall fall before you by the sword (Lev. 26.8). The initial hundred reduce by halving to 25, and 10,000 reduces to 625. Consult figures 17 and 18 for any tonal meaning among the 8 heavily framed. T able 9 summarizes their 11-tone chromatics within its normal limits of 720. but enharmonic reciprocals mandate another octave doubling to 1440:720 displayed in table 10.

The Pyramid Texts of Dynasties III-VI 2686-2181 B.C.

How Egypt confirms the Narmer Data

A very different and unbelievable story emerged in the middle 1970s when the alert editors of Main Currents in Modern Thought – Emily Sellon and her associate Patrick Milburn – introduced Antonio T. Nicolas and me to each other's work (being currently published) – and we found his studies of the Hindu RgVeda and mine on Plato meshing perfectly decades before Jöran Friberg's recent publication of cuneiform arithmetic uncovered the critical supporting evidence. The result is summarized in figure 16 and table 11 as documented in ICONEA 2008 and earlier books. Friberg now displays how Mari scribes of the 19th century B.C. actually computed the Pyramid numbers from more than a thousand years earlier. In figure 19 below I illustrate (on George Hart's time-lines) how Pyramid imagery reflects awareness of a larger mythic limit of 8,640,000,000 in which the moon boat carries the Sun God nightly through the base of a monstrous 'Holy Mountain' from west to east to arise again in the morning between twin peaks displayed there as triangular peak and pit, separated by 13 rows. This boat of millions of years invites attention in this ten-digit integer that factors as twelve millions times 720 days plus nights (required for a Platonic octave of 360 units within 720:360). This mythic matrix (inspired by the Sumerian Ur-text) becomes clearer in Egyptian temples of the second and first millennia B.C. powerfully celebrate (with eventual Greek assistance) by a reduction to only nine percent (to be displayed later, reduced to millions). What matters here is to disclose how upper limits in billions expose patterns that have remained indelible to this day as well-mated 'triangular sevens'. Richard Dumbrill's insight that pentatonic empirical models led the way toward this heptatonic theory requires astute appreciation of Sumerian resources that allowed time to be projected backwards into a mythic past that never happened. We are looking at an heroic exercise in Egyptian duplatio carried out very simply as Spell 6 intimates by adding, now it is 1/6 (meaning 'ten-ness' as 60/6 = 10) that presides over the nether world at the hour of overthrowing the rebel and returning triumphant. Narmer's reciprocal pentatonic central axis now extends to 9 elements in figure 14 - anticipating order in the 8th row of figure 19 to link oppositely pairs of triangular sevens, and function as lightning bolts from the 'Mountain God' on the peak to a scribe familiar with the arithmetic. Insight travels instantly on straight line paths of continued geometric proportion (as scribes learned from earlier storms, a principle that Plato abstracts – so I judge from Friberg's advice and my own experience). Spell 189 says it better: I live on the 7 loaves brought to me: (4) loaves by Horus, 3 loaves by Thoth.[24] This late retrospective comment shapes the whole of Greek theory. The interlocked triangles of the Magen David in figure 17 illustrate a competing just heptatonic tuning consisting of G D A (Plato's means plus 4 tones in the neighbouring row above or below for eleven elements) plus a 'forgotten cornerstone' as asymmetric 12th tone in the middle of the octave.

Figure 19 is a factor analysis in Sumerian brick alignment of male primes 3 and 5 overlaid with triangular sight lines that expose a central rhomb of 7 x 7 = 49 elements (Vedic Marut storm gods)

where near convergences model others everywhere at the same angles and distances – none of which need further computing if we grasp the patterns of 7, 8, and 9 here (on the way toward understanding 'Holy Ten-ness' – perhaps not as it happened, but as authors wanted it to be remembered).

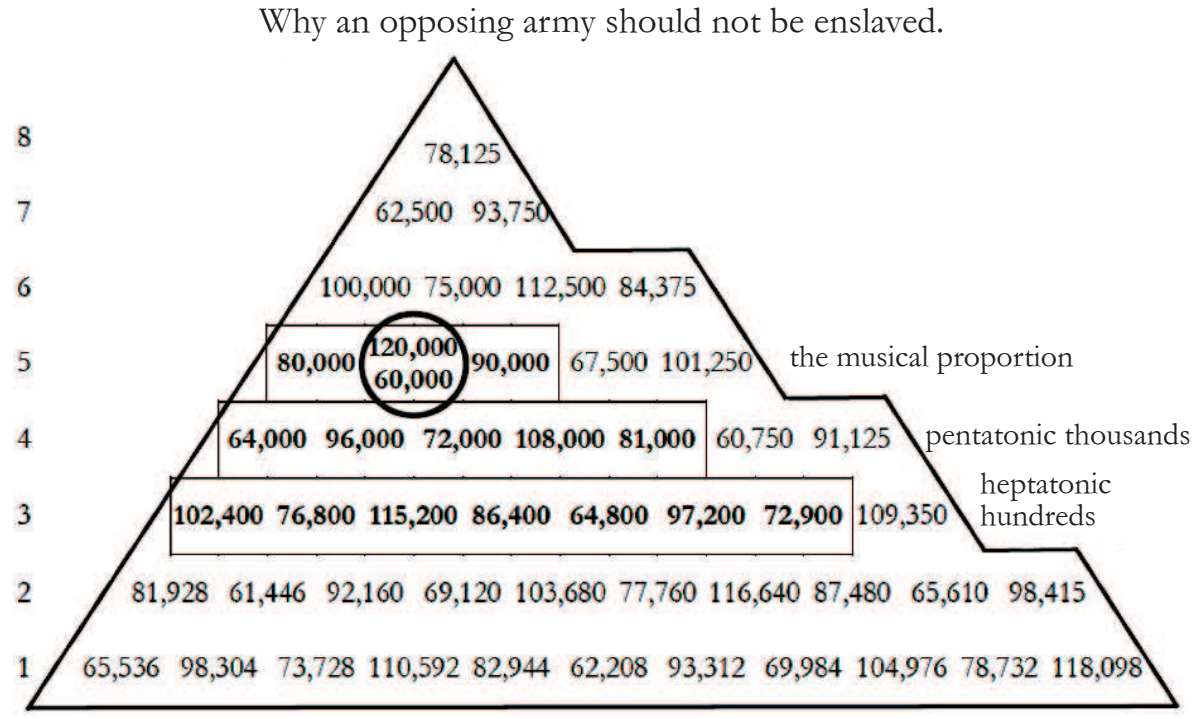


Figure 15. Only three central rows surrounding the throne are relevant tonally; here an insurrection of heptatonic leaders appears in row 3.

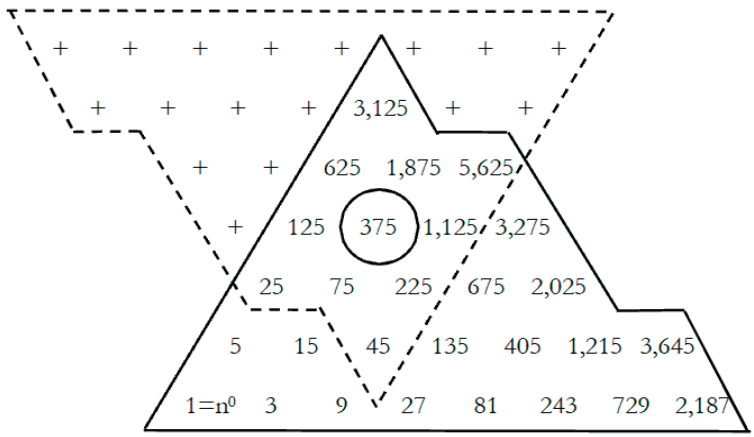


Figure 16. 6,000 disciplined from Above. Notice the severe numerical economy here, with a 'nose rope' to the guarding hawk.

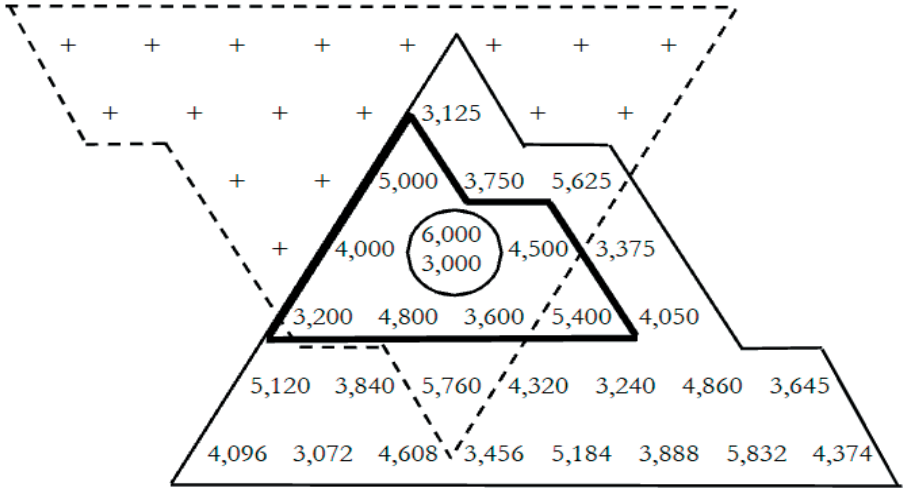


Figure 17. 6,000 disciplined from Above. The heavily framed group of 8 (held by the 'nose rope' are 2-digit leaders of the smallest base 60:30 octave and destined for future supremacy around the throne, anywhere, any time as the ultimate burning bush of divine insight.

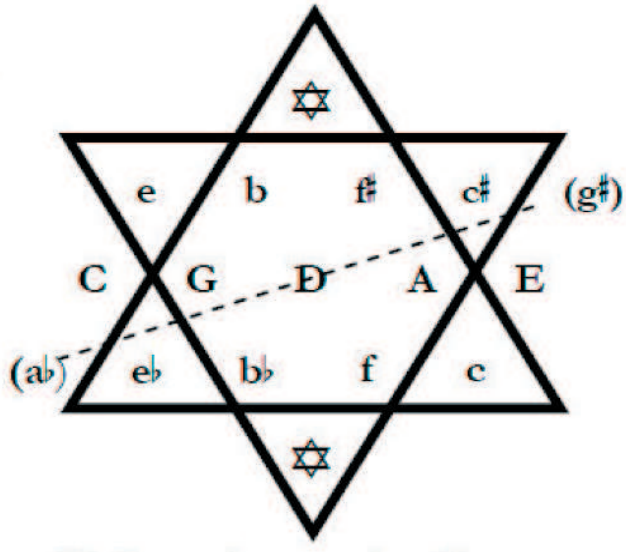


Figure 18. This symbol of ultimate harmonic compression to the ten elements of each triangle in the Magen David (with a temperament adjustion in 'peak and pit') ironically was imposed on the Jews during the Diaspora to become now the proudest symbol on every synagogue and our greatest ecumenical treasure – vindication as a 'God of Knowledge.'

integers	360	384	400	432	450	480	512	540	576	600	648	675	720
rising	D	e^{b}	e	f	$f^{\#}$	G	$g^{\#}$	A	b^{b}	b	c	$c^{\#}$	D
falling	D	$c^{\#}$	c	b	b^{b}	A	a^{b}	G	$f^{\#}$	b	e	e^{b}	D

Table 9. Plato's politicized chromatic self-reciprocal just system.

Microtonal content

Enharmonic *genera* in tetrachords of 40-32-31-30 *versus* 24-30-31-32.								
falling	D	b^b	b↓	A	G	e^b	e↓	D
rising	D	$f^\#$	f↑	G	A	$c^\#$	c↑	D
decreasing	120	96	93	90	80	64	62	60
increasing	48	60	62	64	72	90		96
self-symmetry in 1440::720	1440	1152	1116	1080	960	768	744	720
	720	900	930	960	1080	1350	1395	1440
1440:720 frames reciprocal diatonic, chromatic and enharmonic tetrachords in *duplatio.*								
↓indicates a quatertone lower, and ↑a quatertone higher.								

Table 10.

Similar patterns are mathematical translations and tonal transpositions exhibiting similarity instead of proving it; truth is embodied rather than abstracted. It lies only in the soul. We cannot see something except by way of some prior experience in our possession. Here the reader must see personally how triangular lawfulness from the peak and pit expose naturally (as if by God's intent) a coincidental matrix of 7x7 interior elements that inflamed ancient imagination (by arising in no smaller examples). Under the rubric, 'As Above, So Below', seven spirits rise up for Marduk as if descended from above. (The latter is only outlined here for greater clarity.) Within the triangles no computation is required because pattern is known. But it happens that these cornerstones nearly (but not quite) agree with the central throne. From below the first seven elements in the base are D A E B $F^\#$ $C^\#$ $G^\#$. From Above (reading right to left) they are instead D G C F B^b E^b A^b so that peak and pit are tritones (from D to $G^\#$ or A^b, but not quite in agreement. The great cornerstone of the completed matrix is not 864… but 2^{33} = 8,589,934,592 where the first three digits (864/859) make clear that convergence is much closer than our comma of 81:80 (about 3.3 cents in modern logarithmic values of 100 cents per semitone). This suffices to expose a trivial flaw in creation itself (when restricted to integers). Perhaps all great ancient civilizations assume that creators love man kind best and provide a savior for our survival. Egyptian Pyramid Texts assume that Upper and Lower Egypt has 42 successive districts along the Nile (the number of counters above and below in figure 19). Their union of 22 'Above' (in the south) with 20 'Below' (in the north) is celebrated with 42 nome gods, and in the Egyptian 'Hall of Double Truth' the deceased watches his own heart being weighed against the 'feather of the law to determine if he is fit to live forever in that burial ground across the Nile with Osiris as the dead pharaoh. Memphis is the first of the 20 nomes of Upper Egypt and might conceivably be associated with Shamash the sun as god 20. Applicants must assure 42 gods that they have not violated that god's particular concern. This could be Egypt's confirmation of the truth revealed in the Sumerian grain constant now dated to about 2500 B.C. It is unclear whether this matrix ever was actually constructed as displayed here, necessary to contemplate now what its limits veil. Scribes would have known how to compute only the few details that interested them; here what matters is peak, pit, cornerstone, and the latter's opposite as 3^{20} defining the 21st counter in the lower right corner of the base, and probably also the last counter to the right in the 8th row. The whole matrix, however, survives within the book of Revelation. Nothing more is confirmed in earlier literature except these values and the rhombic pattern 7 x 7 = 49 elements. I am suppressing most detail to expose the bottom line that proves itself to musicians alert to Pythagorean content.

Homeric evidence as confirmatory

The Homeric development of this operatic fantasy must be explored separately in detail, and here I single out only a few trenchant items easily tested. At Troy the attacking sea peoples are the Greeks themselves, cast in the historic role of their own worst enemies in a matrix of 166 elements defined by 8,640,000,000 in the digits. The last counter in the base of figure 19 is Homer's greatest bull, heroic Achilles as 3^{20} (the worthless tail of Tiamat's dragon children, the 9th consecutive Pythagorean comma as 3,486,784,401 – 10 digits, yet unable to fight at Troy until doubled by his virgin confiscated by Agamemnon to solace the loss of his own virgin (he was forced to return the daughter of a priest of Apollo, captured on the way to Ilium, to stop a plague that descended on the Achaians). This algebraic silliness inspired the greatest mythology of the Western world. Double Achilles yourself to see why: it must exceed the half of 8,640,000,000. Think what a feast of Greek comedy we have inherited as a result! Homer represents the Achaians attacking Troy as the rampaging sea peoples, and the bottom two rows of this matrix turn out to symbolize the high seas of holy water fed by the rivers flowing outward from under the temples. Parnassus, home of the gods, is always the eighth row above symbolic Babylon as middle earth. And the rhomb of 49 elements is centered on it. I digress from Achilles to inspect it in a way anyone can test. It became home for the Bull of Minos in Greek mythology.

What descends through history is triangular 7 in peak and pit that must each rest on 8 bricks, and this celestial flaw straddles a fault line. ('Above and Below' need 9 bricks to correlate them, and they are fired to last forever as reciprocals of the first five, hence the display from B^{b} to $F^{\#}$ in figure 14). The self-symmetry of the rhomb is perfect. Abstracting from the mountain permits (and thus requires) reduction to 8 integers.

We may never learn whether anyone ever computed this labyrinth in Egyptian duplatio by unspooling its ratios as Plato suggests, but an adolescent can do it easily today with a pocket calculator for the fun of manipulating fractions. Minos himself is 3^{6} = 729 x 5^{6} = 15,625 = 11,390,625 in the upper right hand corner. The bull in the middle is its cube root pet as 15^{3} = 3,375 that grows by doubling twelve times multiplied by 2^{12} = 4096) into 13,824,000 to exceed Minos and represent the Sun who sees everything as he passes over daily at noon. At 6:00 o'clock we see our Egyptian serpopard tritones with necks entwined, staring into each other's eyes (at least after enough beer with mischievous Inanna/Ishtar – or wine with drunken Jewish fathers Lot and Noah). I suppress Homer's data bank in his Catalogue of Ships, and much else and leap a few bulls myself into Jerusalem's confirmation.

Achilles' Myrmidons (ants)

The full force of Achilles' fighting power at Troy as leader of the 21st fleet of 50 ships with 50 fighting men each (= 50^{2} = 2,500 Myrmidons, ants, also humanly articulated in the middle) is easily tested with Narmer's arithmetic and resulting geometry. The base of their matix is limited to 3^{7} =2187 as eight elements, and he stands on the its peak as 5^{4}= 625 in the fifth row, and thus with four reciprocals above himself. They are represented below in figure 21 with maximum economy to display why, had they ever been led into battle, it would have ended the first day. His most powerfully concentrated forces would have annihilated the middle nine rows of our matrices as the sun crossed the zenith point from east to west at noon at noon! Reciprocation is mapped only at rotation by 180 degrees (until all are doubled and realigned into a tone circle).

This Homeric mapping of the reciprocals of 5 elements to embrace the grasp of 9 elements anticipates Plato's algebra in figure 10 in which successive powers of 60 are always the cryptic products of three corner values. Thus famed Enneads arrive with 9 squared to 81 (and cubed to 729) to avoid computation and speed thought by the assumption of dialectical reciprocation. Plato is not being read by classicists as intended! All other disciplines lie crippled as a consequence. The Ennead (9) retained great symbolic importance into the first millennium A.D., partly as the Egyptian area of a circle for converging conveniently on a square with side of 8 (and 82 = 64 became the right eye of the throne's guardian hawk.)

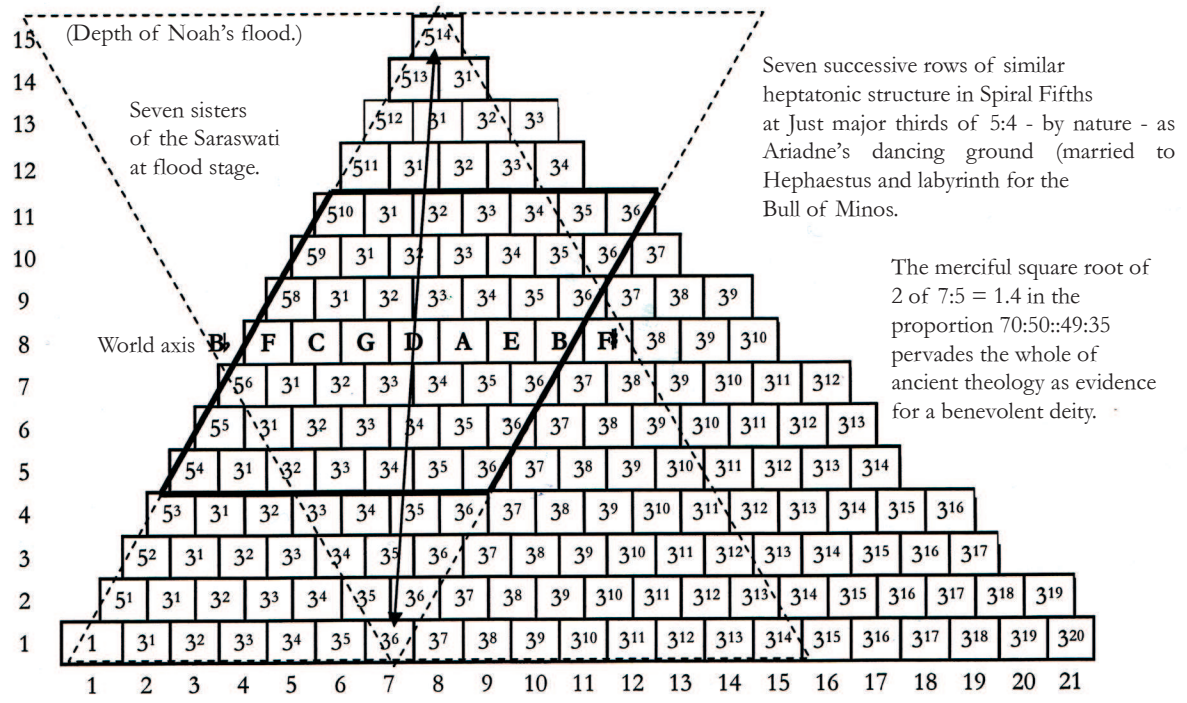


Figure 19. 'As Above, so Below'. Seven rivers of the Saraswati at flood stage are a central rhomb, overlapped by Narmer's mountain of bulls. A lightning ray of insight from the peak travels downward \ to the right for 7 rows in continued geometric progression, then veers to the left / to strike the pit as 7th in the base. Rotation by 180 degrees assures it a return path to the peak among the 8 values from B^b to B in the 8th row. The 7 rows of symmetry in the pit BELOW are the foundation for 7 reciprocals rows in the peak ABOVE in Babylonian lore, a idea lampooned by the Jews, as if anything could have happened that way.

The 7 x 7 element labyrinth abstracted in smaller integers						
8,000,000	12,000,000	9,000,000	13,500,000	10,125,000	7,593,750	11,390,625
12,800,000	9,600,000	7,200,000	10,800,000	8,100,000	12,150,000	9,112,500
10,240,000	7,680,000	11,520,000	8,640,000	12,960,000	9,720,000	7,290,000
8,192,000	12,288,000	9,216,000	13,824,000 6,912,000	10,368,000	7,776,000	11,664,000
13,107,200	9,830,400	7,372,800	11,059,200	8,294,400	12,441,600	9,331,200
10,485,760	7,864,320	11,796,480	8,847,360	13,271,040	9,953,280	7,464,960
8,388,608	12,582,912	9,437,184	7,077,888	10,616,832	7,962,624	11,943,936

Table 11. Twenty-four pairs of tones around the throne and within the rhomb (2x24+1) define 49 symmetries invariant under reciprocation.Just tritones are boldly framed to limit Platonic necessity to the 15 elements of the three central rows of figure 19, C G D A E and their natural Just thirds both Above and Below.

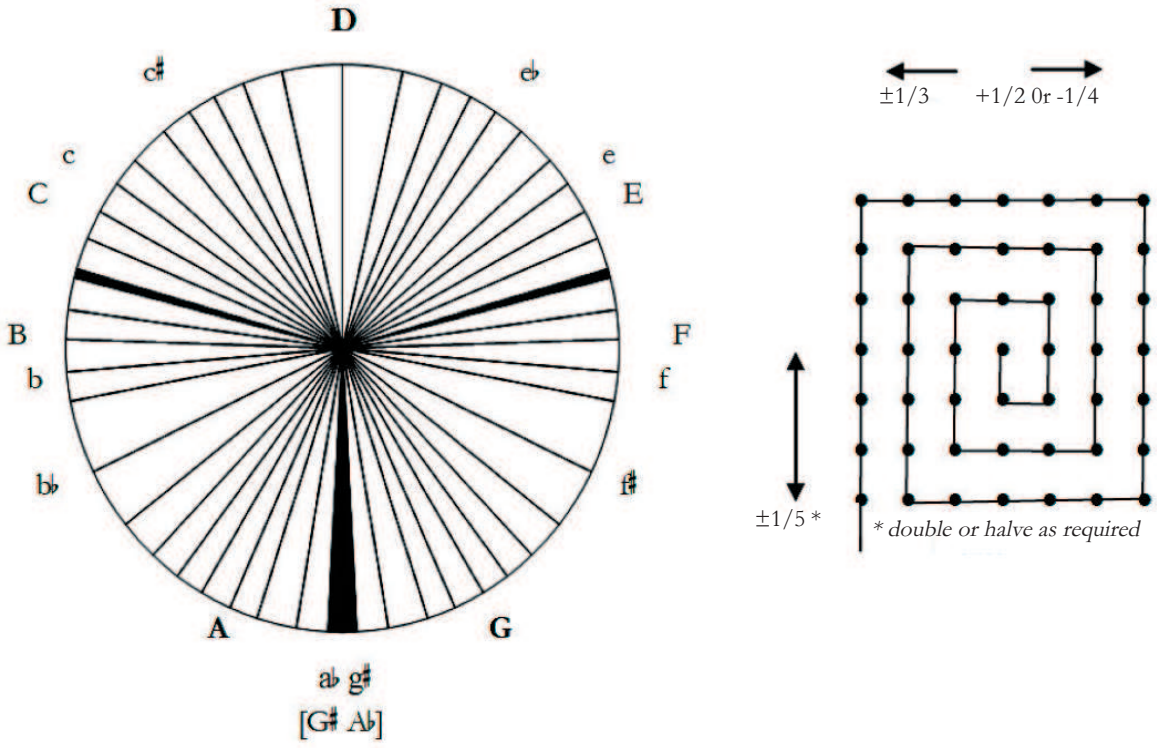


Figure 20. Paired ratios within the rhomb (as Homeric dancing ground for Ariadne). (My conversion of ratios to angular measures has created the false appearance of one pair of better correlation in heavy black lines between E:F and B:C.)

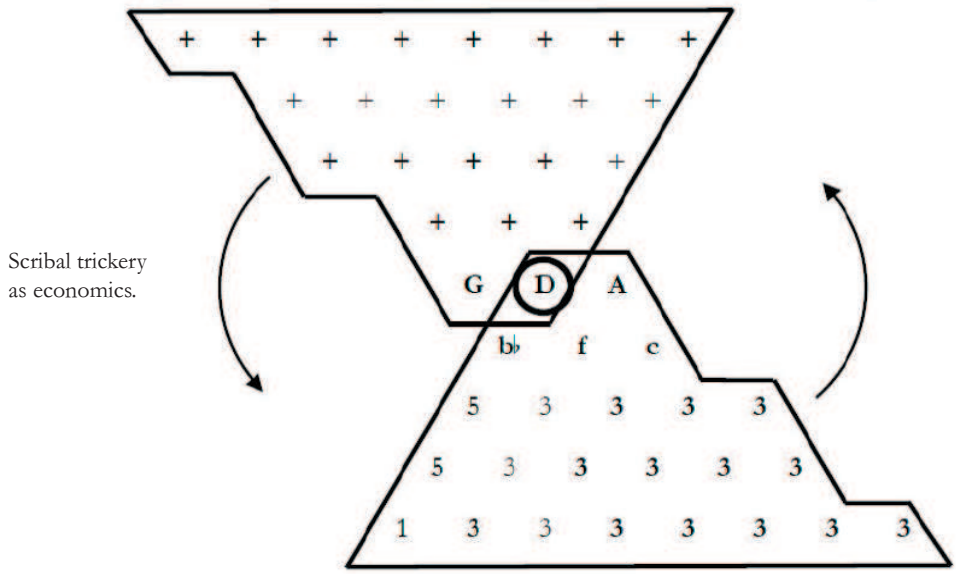


Figure 21. Paired tonal symmetries in the Just arithmetic of Platonic civilization. Achilles' Myrmidons (ants, articulated in the middle like humanoids), never loosed on Troy's tower in figure 22 following, for they would have wiped out the 9 central rows on the first day of fighting, ending the Trojan war 20 years earlier.

YHWH's World

(10.5.6.5 as $6^5x10^5 = 60^5 = 777,600,000$

His power is infinite; his Chosen are promised a domain they never planted or tilled, and a special mission in the triangles of the Magen David where a strict Justice is four, enthroned on Abram (1.2.200.40 summing to symbolic 3^5=243) as sixth element in the sixth row and middle earth, eighth below the peak, so that predictable harmonic lawfulness from the peak as triangular 13 is still 8th below Parnassus, home of the gods.[25] (Later the Jews will dump them into the salt sea.)

In figure 22 this matrix surfaces naturally with the reorganization of base 60 that gave it floating place value, perhaps in the last two centuries of the third millennium in the final flowering of Sumerian culture before Babylon absorbed both its language and its mathematics intact. Another very subtle scribal trick is veiled within its famous twin peaks for God as Bull on the mountain in the 13th row is defined by 5^{12}=244,140,625 that must be doubled into 488,281,250 where he fathers his only begotten son at the ratio of 2:3 (add one-half) at 732,421,875 as a very human fiver and unquestionable Trinitarian – a natural gift of floating place of twin peaks at 60^5 that no scholars including myself have recognised in our publications. It has been understood within Hindu mythology for at least 3,000 years – and before Judaism separated itself from the world's 'other people.'

The meaning of seven

The casual counting of left-overs as seven semi-tone hours within the perfect fifth of 2:3 – exploited here – is accompanied by fortuitous coincidence that the ratio of 7:5 (=1.4) approximates the square root of 2 in the middle of the octave, thus mating it with its reciprocal (both slightly too small, resulting in the proportion 70:50::49:35 that is naturally self-symmetric with its inverse at 35:49::50:70 isolating a gap of 49:50 that straddles the square root allowing sacrifice of the one within to forgive a one-percent error in either direction.

The great hexagon in figure 22 displays a heptatonic modal system on its central axis (F C G D A E B) defined by 432,000 but Bible authors favour instead a pentatonic symmetry C G D A E extended to the right (by octave doubling) for their new song by only 144,000 male virgins (men who have not known women in the Revelation chorus), easily confirmed from Narmer's tables and geometry. The interlocked triangles of the Magen David restrict symmetries even more severely than Plato's limit of factorial six = 720 (as 1x2x3x4x5x6). Egyptian Spells attributed to the Pyramid texts during the 2nd millennium B.C. demonstrate familiarity with other functions for prime 7. Chance operates in full vigor as a deity, as Plato affirms and Theology denies (according to our own sense of humor). Spell 64 affirms: (There are) 7 steps in this ascent (cited above….). Spell 189 declares: I live on the 7 loaves brought to me … Spell 145 refers to the Foremost One, tranquil 'Possessor of Power, Offspring of her Lord', 350 hundred-cubits in circumference – meaning 35,000 that reduces by 5 to only 7,000 and by 7 to only 5000. The ratio 35:36 is an excellent just quarter-tone (more accurate than 30:31 and 31:32), and 36,000 plays a central role in Ancient Near East cosmology as second largest counter in the earlier base 60 arithmetic of Narmer's time, and now again as 60^2 in new floating place value, linking Sumerian science to Babylonian development with echoes of both, elaborately celebrated in Egypt. Spell 145 later has Osiris declaring: Make way for me for I know thee, I know thy name … 'Possessor of Power' as of offspring of her mysterious realm, 300 hundred-cubits [30,000] in circumference, millions of millions of cubits in depth and in the height of her Summit. But the same spell declares: 'Possessor of Power', offspring of mystery, 360 hundred cubits (long) in her winding, 102 millions of millions being on her (to) every road, sown with green stone of Upper Egypt, who betrays not secrets but veils the weary one, …[26] The perfect 11 – tone self-symmetry of 60^5 = 777,600,000 – the secret of Delphi revealed by Plutarch-- inspires the notion of 600,000 Jews fleeing indentured service to Pharaoh on the same route mapped by Narmer -- perhaps before 3000 B.C. as the sixth row of a matrix.[27] (This dating, however, may prove elusive. If so, the facts correlate otherwise.)

Hebrew parody of the Marduk/Baal universe. 15,625,000,000 measures of holy oil for all time (Exodus 30:23-24) preserves and ridicules its limits. (Compute as 500x250x250x500, and map only factors of 3 and 5. Octave doubling, despised by Plato but approved by YHWH for anything he loves (Gen 41:32), produces merely cyclic repetitions of potential tones. Six working days in Genesis 1 provide all materials as integers 1, 2, 3, 4, 5, 6 (no straw is needed for Jewish bricks in this offset alignment).

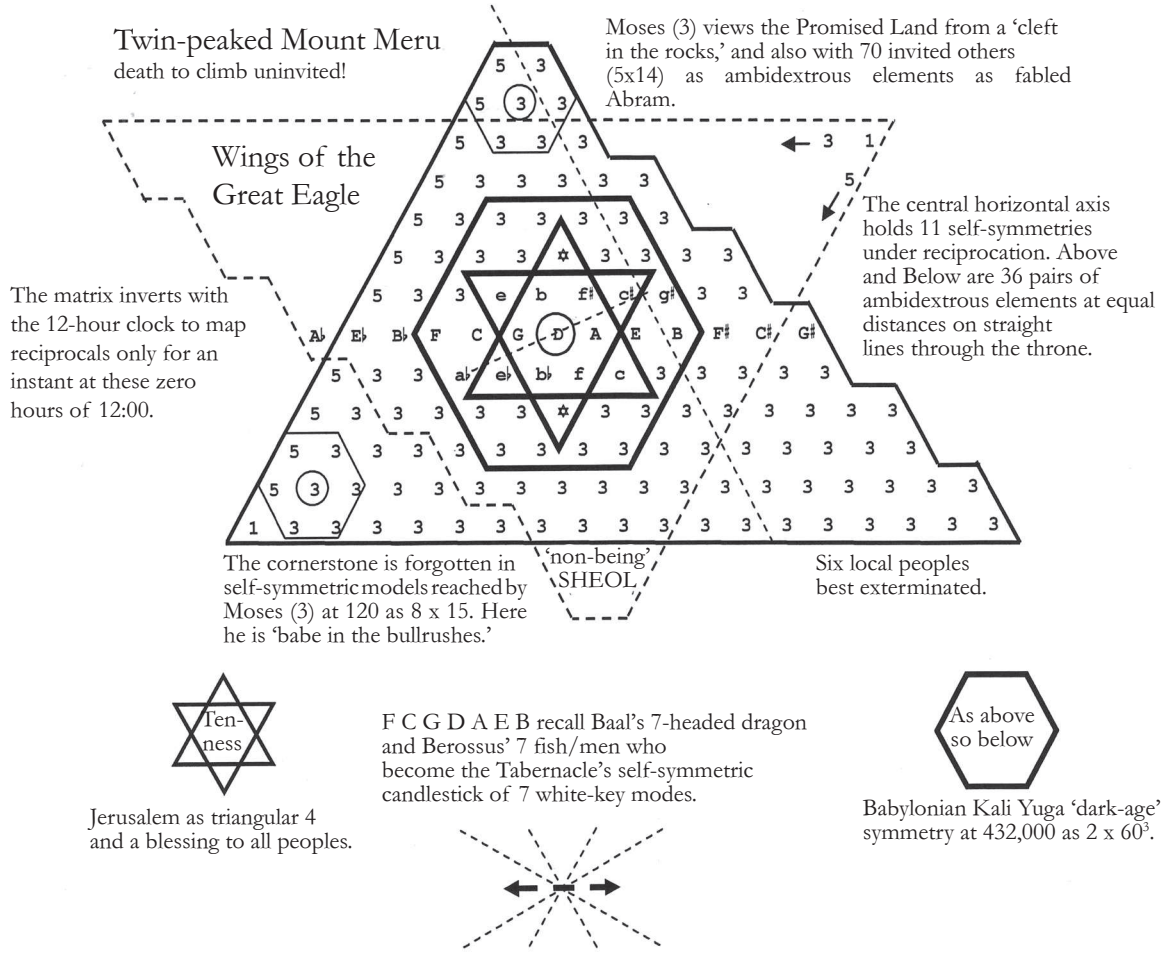


Figure 22. The famous twin-peaked holy Mt. Meru is the regularized Babylonian matrix for 60^5 = 777,600,000 that inspired the flight of 600,000 Jewish brickmakers from Egypt, and the Greek idea of Hermes Tristemegistus as 'thrice Holy conductor of souls.' Homer's profound irony furnished that harmonic foundations of Greek mythology for the next thousand years. Its comedy is brilliant harmonical allegory. The large central hexagon frames the symmetries shared also by the Kali Yuga dark age of $2x60^3$ = 432,000 years. But New Testament Christology conceived itself as set apart musically by one-third meaning 432,000/3 = 144,000 as four times the Hebrew Jubilee re-distribution limit of 36,000 displayed later in figure 25. The Magen David triangles here are the ironic gift of further algebraic reduction by the severe anti-Semitism of Christianity as identification of the Jews, now proudly displayed in every synagogue. (This story requires further separate exposition.) The triangles are Sumerian, but new significance is owed to an enemy as the Holy Fire itself, brought down from heaven, clearly visible in its interior hexagon embodying divine authority.

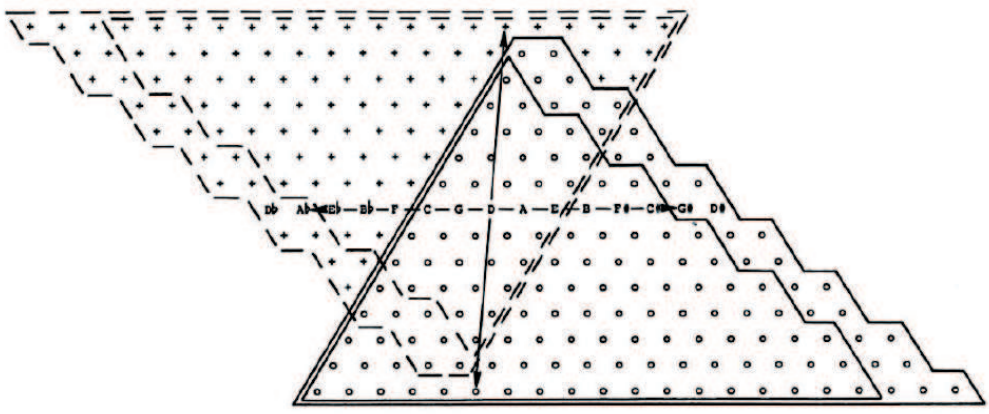


Figure 23. The Hall of Double Truth (Meat): Yantra for Numbers 3^p5^q < 360,000,000 and < 3,960,000,000 (Generated as 3,300,000 "with" 1,200).

The fifteen elements of the central axis from D^b to $D^\#$ can be thought of as the domain of Osiris, and the five invariances under reciprocation – C G D A E – are the five gods of whom he is chief. The fourteen vertical rows (the fourteen parts of the body of Osiris) wax and wane (like the moon with which he was associated) with multiplications and divisions by 5. The twenty-one elements in the two outer rows correlate with the forty-two judges in the Hall of Double Truth.

How the Pyramid texts support this Narmer reading

Perhaps the strongest support for this Narmer reading is the Egyptian Book of the Dead itself. The number we are looking for can be found, I believe, in chapter 64 of the Book of the Dead where the Sun-god Rā addresses the Spirit-Souls directly. 'I work for you, 0 ye Khus,' he says, and then numbers them very curiously as 3,300,000 with (sic) 1,200. Early translators were tempted to add these numbers, but there is no excuse for addition to reach a sum which could have been notated easily. The connective 'with' is now considered problematical. If we dare to try interpreting it as a command to multiply – 3,300,000 × 1,200 = 3,960,000,000 – we reach a product which falls within the limits necessary for a yantra fourteen steps high and with twenty-one elements along the base, as shown in chart 50. But there is a problem: we have never yet dealt with afactor of 11 in an index. Let us eliminate it : 3,960,000,000 ÷ 11 = 360,000,000, *i.e.*, the number of days in 1,000,000 years. I have graphed this smaller number within the same yantra as the larger one, and suggest that it may represent the resurrected Osiris, for when he had been treacherously murdered and his body cut into fourteen pieces multiply – 3,300,000 scoured the Underworld for the scattered parts of her husband and found only thirteen of them, the phallus having been swallowed by a fish. There are only thirteen steps in the yantra for 360,000,000 hence our double yantra might be considered the living and the dead or resurrected forms of the god. Now the Egyptian sky was divided into thirty-six decans (like the year into thirty-six ten-day weeks), every ten days a new star having the privilege of signaling the Sun's rising by preceding it over the horizon by a few minutes. A huge number whose only digits are thirty-six would seem characteristically Egyptian, especially when the sun travels in a boat of millions of years, and when 360 are the days in one year and 360,000,000 are the days in a million years, and when 11 × 360,000,000 = 3,960,000,000 is the smallest multiple to produce our 'Hall of Double Truth' with its lunar overtones, with the almost requisite ten tones along the horizontal axis, and with its correlation with the Hindu Chariot of the Gods (in Chart 17) where the horizontal axis extends to the east to 37 times our reference D, while the vertical axis extends to 5±7 from the horizontal axis, an emblem of completeness. According to Plutarch, thirty-six was the sacred quaternion of the Pythagoreans, given the name of 'World' since it is made up of the first four even numbers and the first four odd numbers added together.

I cannot resist a brief digression again to share the biggest Jewish jest at Pythagorean

pontification, undiminished today. Authors of Exodus did it, perhaps even with Babylonian help during the exile, by discovering a way to crowd a 22nd element into the base of figure 19, enthroning the 13th row instead of the 15th (to balanve thw lateral reach of 13 tones). Here in figure 24 is cultural comedy in its finest hour; Semitic scribes never underrated themselves.

The cosmological extravagance of 8,640,000,00 visible to scribes anywhere, is coyly alluded to in the Babylonian creation mythology of Enuma Elish that defines the 21 elements in its base as the 20 children of fearsome Tiamat, dragon of the deep; nine are named and followed cryptically by 'eleven more' – all bearing mantles of radiance and made godlike (see Stephanie Dalley, pp. 237, 239, 245, 247 in Myths from Mesopotamia.)

The mountain is created by mixing the blood of her slain lover with clay from which to create people (in tablet VI), a deed impossible to describe. Fortunately we learn from the flood mythology of Atrahasis that wise Mami, the womb goddess, pinched off 14 pieces of clay divided 7+7 for the 14 steps of the ascent to 514. There is no way to do justice to Dalley's brilliant translations and commentary except by detailed study of her work, and with extensive citations, not possible here.

The Holy oil matrix is sealed and thus rotates on the 1st counter in the 13th row where its defining element of 5^{12} is doubled 6 times (to act as limit). The 14 elements in the top 4 rows coincidentally preserve the patriarchal burial ground (with a double cave) that ambidextrous Abram, thinking ahead, buys for only 400 shekels.

Examine the Hebrew jubilee limit of 36,000 in figure 25 that Sumer and Egypt explored on the way toward liberation from this giantism, and that Mari scribes were computing by – bull leaping in Hammurabi's time. (Computing 9 to the tenth power to reach the 21st pitch class in Spiral 5ths for figure 19 is simple; compute instead powers of 10, and subtract successive products of 9 as in 9x10=90, and minus 9=81 as reached above in table 2.) In the matrix for 36,000 we learn several useful lessons from its pentatonic symmetry.

Nine of the ten antediluvian kings in the list of Berossus reigned for years in this mapping (some at double or half ot these figures), and the first six in the Sumenan King List compete with each other also [28,800-36,000-64,800 (double of 32,400)-43,200 (double of 21,600)-36,000-28,800] in ways to suggest the possibility that all competition may have been musical. The Jews' 40 years in the wilderness as 40x720 days plus nights is 28,800 (as 20 times Adam's 1,440). The near coincidence between the cornerstone 327... and the ninth value in the second row as 328... inspires the notation of a redistributive economy at the limit of 36,000 as 50 years with sabbaticals at every seventh. Here are 40 contingents ot 5-digit integers, and doubling 20,000 to 40,000 identities Joshua as leading the invasion ot the Holy Land from that position and then refusing kingship to return to his own place – with no effect whatever on boundary, but only on temporary distribution ot power within it. Bible creationism was tested carefully for at least 2,000 years. Spells 63 and 81 associate Horus with a 1,000 units of bread, and as a falcon 1,000 cubits long with 2,000 live beings in his charge. Experience is followed by extreme compression.

An algebra for this entire system was published by Patrick Heelan, S.J. in 1979. Figure 25 is his schema in a notation some musicologists already employ. Heelan's partially ordered lattice is a 'veil of the temple,' with tunings (T) identified by largest primes (3, 5, 7, 11 within the octave T_0 in which T_{11} enters ambiguity and chaos (infinitely useful in the technology ot the arts).

When Cyrus freed the Jews from bondage to Babylon in the sixth century B.C. they responded by imagining him as Savior, and produced, in the book of Daniel, four observant Jewish young men (restricted to Kosher food) to rule the realm for him. We see them here in table 12 as C G D A (1-3-9-27, summing to 40) in their values in the Gilgamesh temple, now multiplied by 7 to display his leadership at 12,600. (Another factor of 9 avoids these later Greek continued fractions of 888... and 666... in the lowest row, and raises the integer reference of D to 9x12,600 = 1,134,000 -- still within the 'grain pile' ceiling of 1,152,000.) Test this speculation yourself by ratios of 63:50 both 'Above and Below'. (Complete the lower row in reverse by the algorithm 'add or subtract one-third' at each step to see a speculative Greek shortcut.)

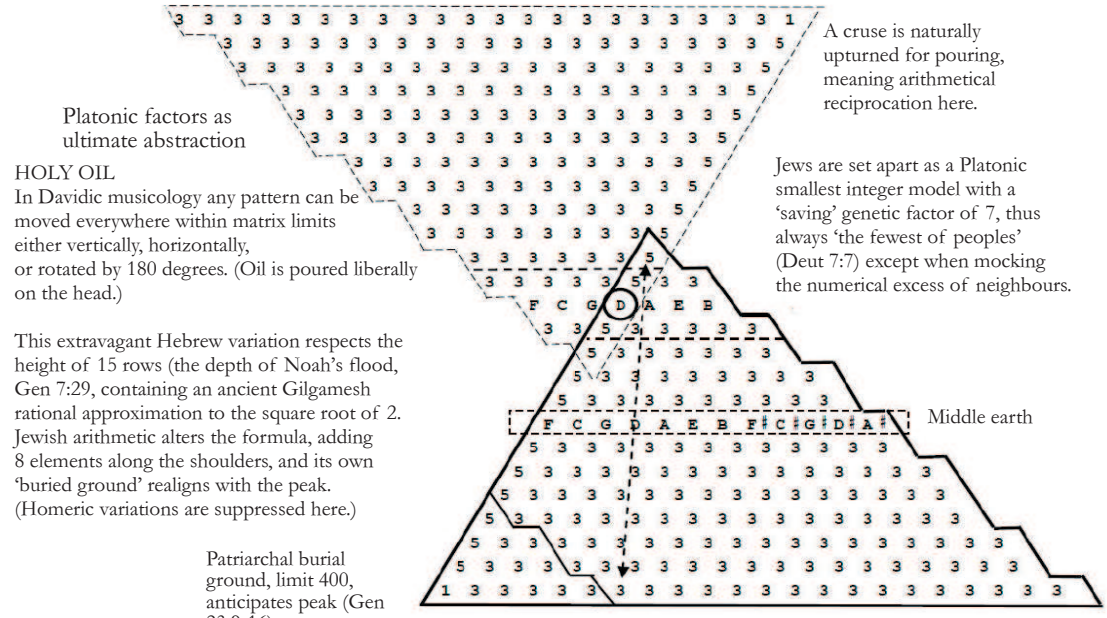


Figure 24.

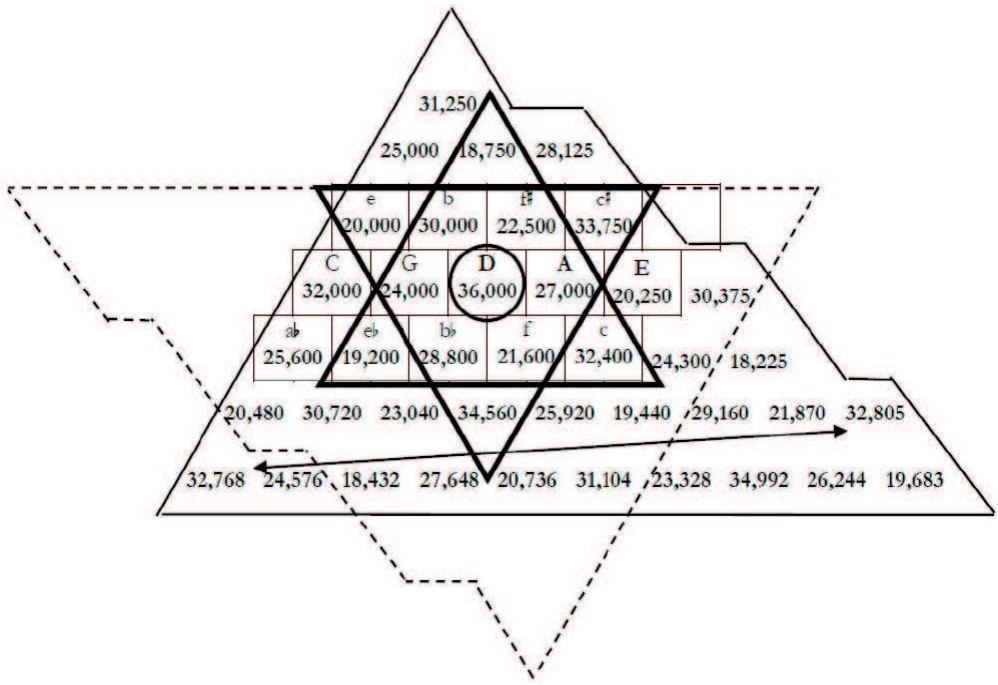


Figure 25. Hebrew Jubilee redistribution at 50 years (50x720=36,000). Near coincidence of the cornerstone (32,768) with the last value in the row above (32,806) renders further computation superfluous, thus sealing the necessary theoretical base at ten elements. There is no need for a Just harmonic theory that exceeds 36,000 – Sumer's largest counter.

Figure 27 is a panoramic virtual harmonical mythology of past, present and future computed *ca.* 2000 B.C. and modified by New Testament eschatology. New Jerusalem as the cube of $12{,}000^3$ = 1,728,000,000,000 frames the virtual history of harmonic mythology for all time in Plato's notion of the good, never anticipated by him as the end of time but powerfully motivated by historical events. The living present (of 777,600,000) is the much smaller twin-peaked Mount Meru of regularized base 60 notation (in heavy dotted lines).The doubled border on the lower nine rows enclose 153 great fish from the appendix to the Gospel of John, rescued by the twelve fishers of men who follow the risen Savior (F) in the tenth row as Heaven. This cube adds two rows of Holy Waters below the Gilgamesh flood limit of 8,640,000,000, within which the YHWH/Apollo limit (exposed by Plutarch) is only nine percent, and with three fewer rows of waters below, always draining from the temple on their way to the sea.

The male choir of 144,000 male virgins is framed within the city limits singing a new song in which Egyptian pentatonic perfection (C G D A E) is extended to B and $F^{\#}$ for a new heptatonic freedom among seven diatonic modes (any limit can be doubled to define a mode by corralling the bull within in it). Vertical arrows point to the original inspiration for this extravagant numerology as a better rational approximation to the square root of 2, exposed in the Sumerian grain pile dating to about 2500 B.C. The limits of the ten-digit Marduk/Baal flood of 8,640,000,000 is parodied here in multipli cation by 200 to the nearest cube (geometrical metaphor for a number raised to the third power). The risen Jesus at this second resurrection is assumed to be the 888 by which he is identified as 8x8x8=512 (formerly child Horus) in both spiral 5^{ths} heptatonic and just 12-tone chromatic ancient tuning systems. Here he leads twelve disciples in the tenth row doubled into 2x512 = 1024 as a second return (as a new referent of 1,024,000,000,000 for his row). Their 13-digit defining numbers can be tested from his from left to right by the algorithm, subtract one-fourth or add one-half until its 9 places can be exhausted. Peter (Cephas as stone and meaning the Beast 666 read chiastically as 3x3x3x3x3x3=729 in Greek notation) is the position of the tritone *diabolus in musica* that brought Gnostic ridicule on the Roman pope, but is the natural center of 13-tone symmetry, conceived by Plato as tyrant of 9 cubed to 729 and defining alternate tritones of 729:512 in spiral fifths. This warfare is inherited with life itself; we are forced to choose between alternatives that only God can ensure with integers. Double lines enclose the 153 great fish caught under Jesus' instructions (standing on the shore) in the Gospel of John 21:11. Peter, stripped for action as 729 sprang into the sea (he belongs to the right diagonal/shared with the great dragon of Marduk-Baal mythology (leaving six in the boat).

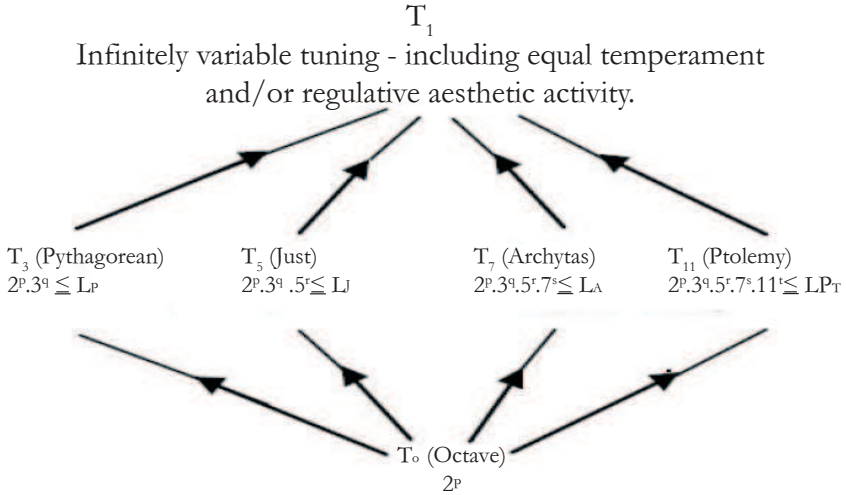


Figure 26. Laticce of musical tunings.

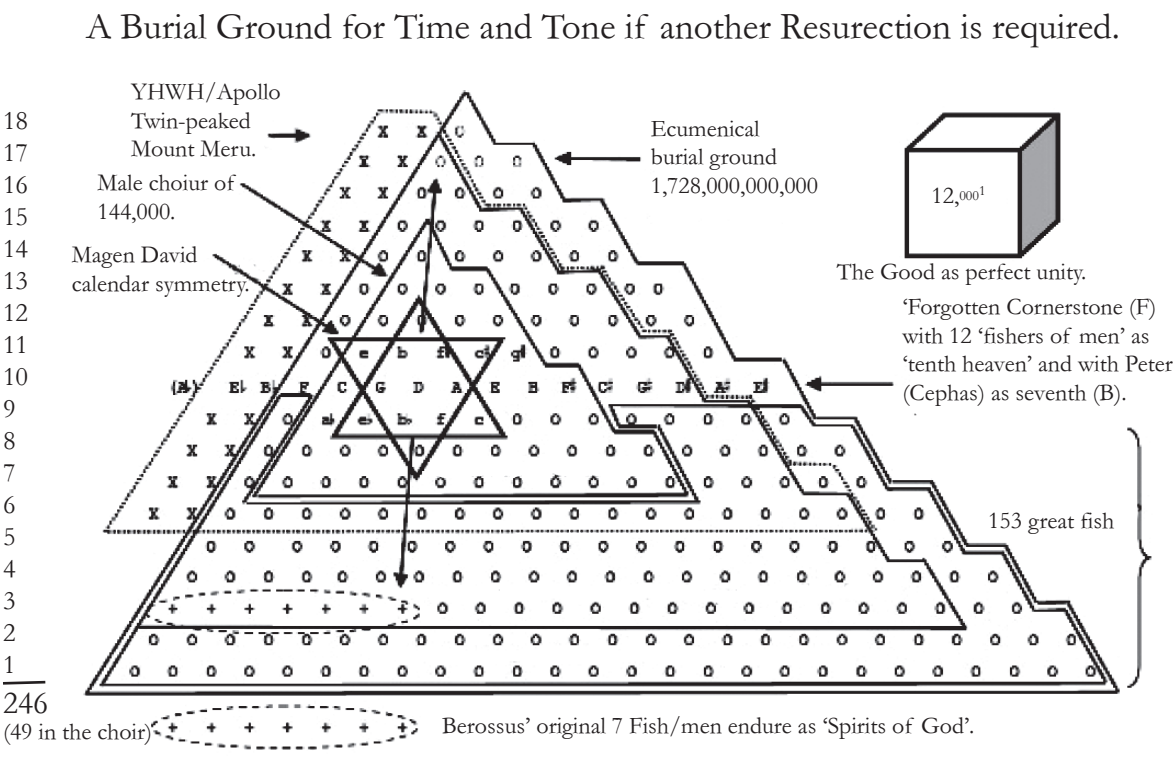


Figure 27.

The other disciples were about 200 cubits off – the factor that produces the cube of New Jerusalem as 200 times the Marduk limit of 8,640,000,000.[30]

Conclusions

The Narmer mace-head and palette inscriptions fueled a tremendous display of mythological events in the Pyramid texts that followed in the next millennium and the twelve-tone base of spiral 5ths among his bulls became the scene of the sun's nightly journey in the moon boat through the 12 hours of the night (protected by the 10 female Hours) in the base of his mountain, threatened by serpents at every portal. I hope this reading leads toward a better understanding of the imagery all the way. In such elaborate ritual it seems a pity that serpopards ever disappeared for they seem a perfect complement to a tuning theory that possessed paired 13-tone deve-lopment and competing pairs of tritones plus an intricate internal symmetry integrating a multitude of tonal perspectives. Those symmetrically flat-footed beasts with intertwined necks and heads overlooking the ritual circle intended for preparing eye paint could be Vedic priests imaging themselves as frogs around a pond, croaking their songs. We might think of them now as ourselves as archaeomusicologists still pondering not about what twelve is but rather about what music is. We have not yet fully plumbed what God hath wrought in the magic of the musical octave.

We need to put our musicological house in order so that lovers of other disciplines can understand also. Table 12 and figure 28 display how simply Egyptian methods could have defined equal temperament boundary markers within the accuracy we can tune aurally today.

I am grateful to Peter Blumson (Pete Dello) for presenting a first draft of this to the conference, necessarily truncated there by excessive length. Dialogue has been the essential instrument of progress, and if some of this story can be believed then dozens of colleagues must be named for contributing ideas and criticism along the way. Mountains of supporting evidence must yet be presented.

The Gilgamesh ratio of 1.26 - employed symmetrically as divisor and multiplier of the first four tone values in Spiral fifths tuning define a cube root temperament within his own city and suggests why he was granted immortality only in the underworld. Notice two continuing fractions (.888 and .666) important to Christology.

x 63/50	E = 14,112	B = 10,584	$F^{\#}/G_b$ x 1/2	$C^{\#}/D^b$ = 11,907
reference fifths	C = 7 x 1600 11,200	G = 7 x 1200 8,400	D = 7 x 1800 12,600 : 6,300	A = 7 x 1350 9,450
x 50/63	$A^b/G^{\#}$ = 8,888,888...	$E^b/D^{\#}$ = 6,666,666...	$B^b/A^{\#}$ = 10,000	F = 7,500

Table 12. A potential unequal 12-tone Just Temperament. The lower row may have been inherited from Greek practice working from right to left with the algorithm add or subtract one-third (at each step). Thus the continued fractions of 666… and 888. emerge naturally and sparing the limit of 12,600 another factor of 9.

APPENDIX I

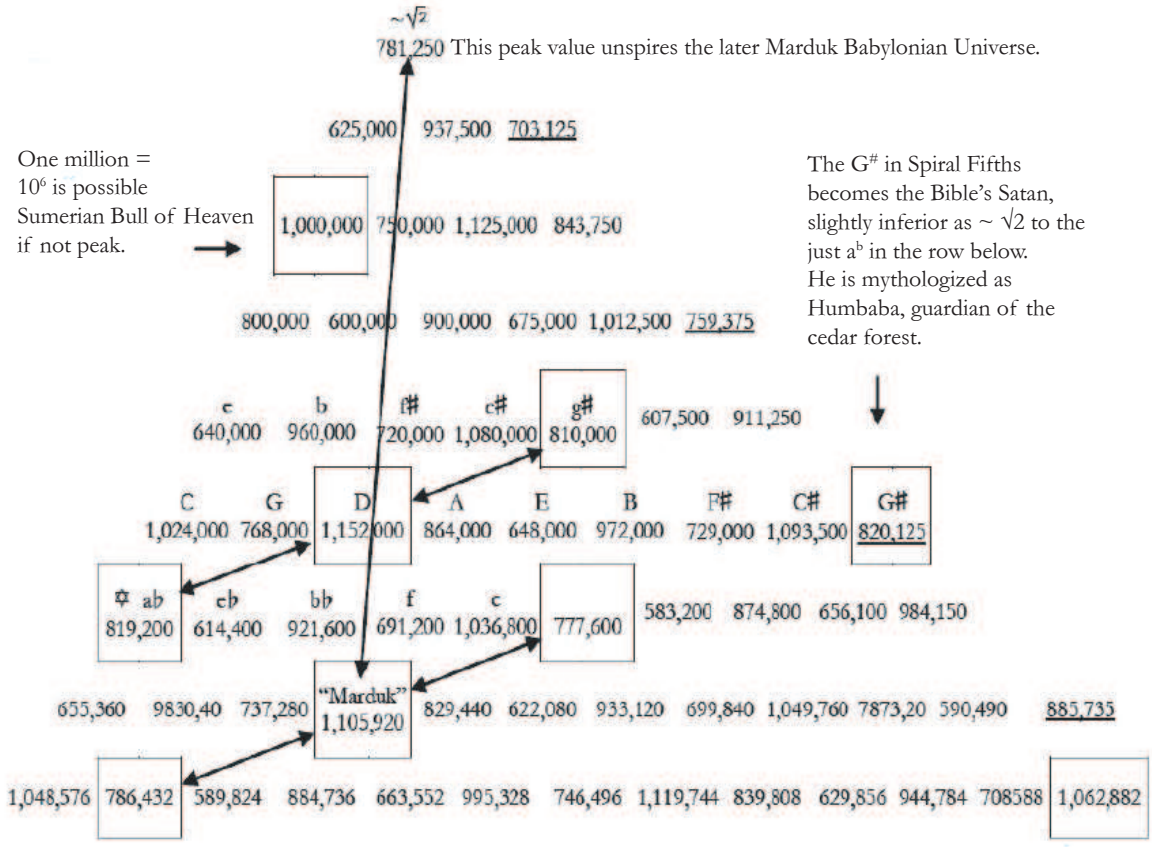


Figure 18 in ICONEA 2008, fully quantified. Fighting men become Platonic brothers when projected in the same *double*. The result is a possible model for Uruk in the reign of Gilgamesh and the locus of adventures in the epic named for him.

The Pythagorean comma as 13th pitch class in the base is doubled to lie within the grain-pile limit of 1,152,000 and so it exceeds its cornerstone referent within the D octave in the fourth row. (These leading digits return in the 10th row of the Revelation cube.) However, on the central axis the heroes' week-long adventure takes them from Uruk on D to the spiral 5ths tritone G#, where 820,125 proves itself demon of the forest (Humbawa) to lie beyond the just tritones a-flat and g-sharp as 819,200 and 810,00 (in rows 3 and 5) now exhibited as better square roots. But this pattern is repeated two rows lower, straight down where its just tritones (now 786,432 in the base and 777,600 in the third row, surrounding the future Marduk) expose the peak (bull of the mountain) at 781,250 to be far closer to the middle in the 8th row above.

This scribal insight (hidden from others) allows the better approximations to be paired above and below from the fourth value in the eighth row of a matrix of 15 rows with no more calculation. And so the new horizon of 8,640,000,000 is disclosed to the scribes within this limit of only 1/7,500. We have penetrated the numerical code on ancient harmonical mythology merely by following Plato rigorously as he abstracted science inherited from Homer, whoever he was. This could never have been presented publicly in ancient times. The grain pile fed all harmonical mythology for 3,000 years.

Notes

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5 Budge, E.A.W., *Amulets and Talismans*, University Books, (New Hyde Park, 1968) p. 467.

6 Lindsay, A.D., *Plato: The Republic*, Dent, London 1906 -1964), p. 119 (Stephanus 432d).

7 Collon, D., *The Queen of the Night*, British Museum, (London, 2005); McClain, E.G., ICONEA 2008, p. 92.

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9 Hart, G., p. 76.

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11 Kappraff, J., 'Beyond Measure: A guided Tour through Nature, Myth and Number', *World Scientific*, (New Jersey, 2002), pp. 54-87.

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15 NRSV Ex. 9:12

16 Plato's Critias 114-117

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21 Allen, T.G., 'The Book of the Dead or Going Forth by Day,' Oriental Institute of the University of Chicago, *Studies in Ancient Oriental Civilization* No 37, (Chicago, 1974 p.59.

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28 McClain, E.G.. slightly modified Figure 14 in *ICONEA 2008.*

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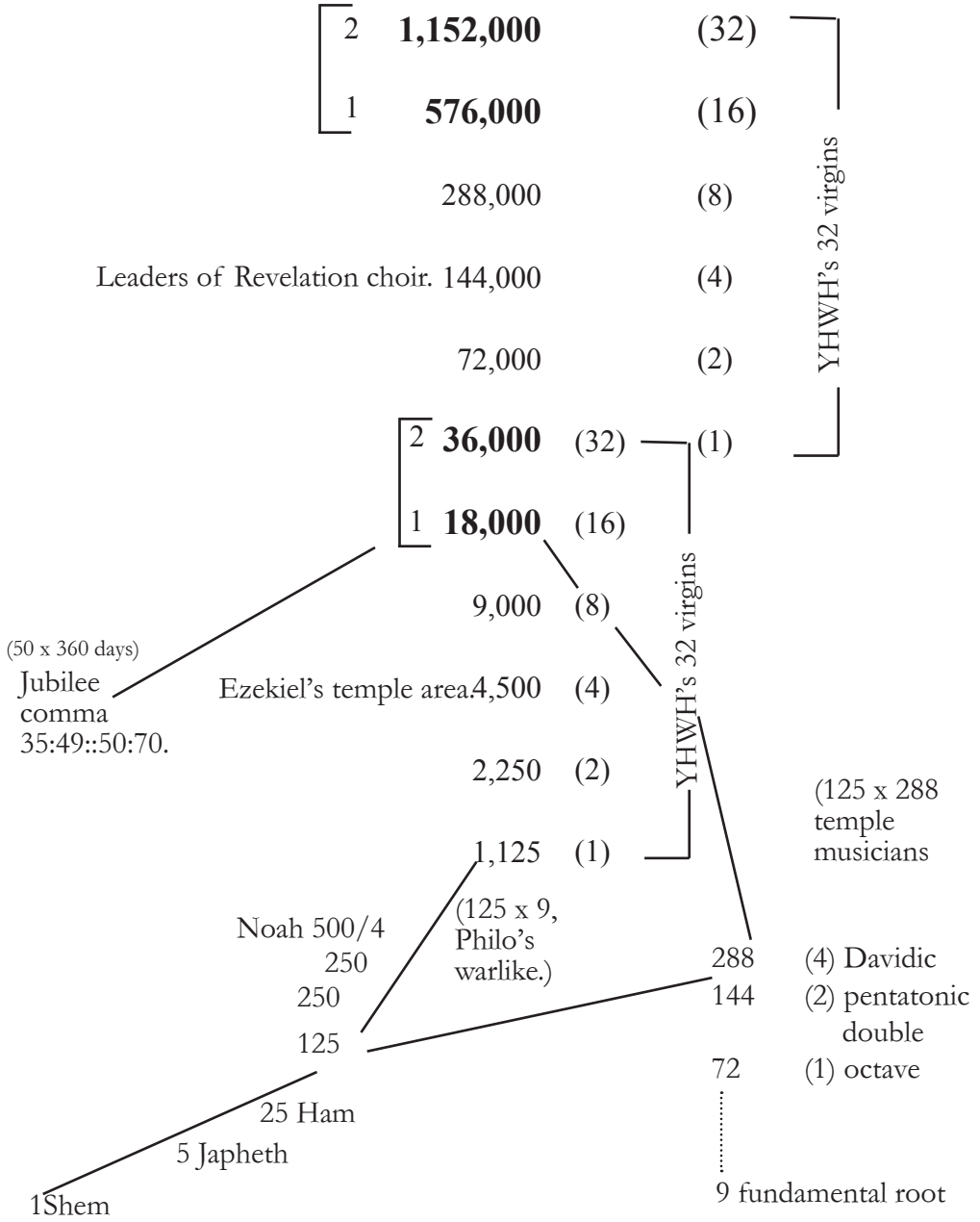
APPENDIX II

Dialogue with many others has contributed powerfully to the ideas offered here. I am grateful to Peter Blumson (a.k.a. Pete Dello) for presenting a preliminary draft of this essay to the symposium. He has abstracted a central theme in the history of Pythagorean musicology mapped as a time line: repeated sequences of five doublings (25 =32) promote 32=9 (Philo's most warlike of numbers) directly to the Sumerian grain pile Ur-text limit of 1,152,000 units in a way Bible scholars should find particularly valuable. Moses assigned 32 virgins to the High Priest's office.

Some Bible Music ebbing and flowing from the Shuruppak tablet.



MUSIC THEORISM IN THE ANCIENT WORLD

Richard Dumbrill

Theorism[1] *is a conscious state which came as one of many consequences of literacy. This led to empiricism, to rationalism, to epistemology and finally materialised as theory as we understand it today. In the present paper I shall demonstrate how this concept shaped the theory of music in the Ancient World and how it influenced our own perception of theory.*

Part One:
1 Introduction

Preliteracy would have been the scene of isolated forms of theorism. Archaeology supports this postulation with the discovery of markers[2] (fig. 1) of different types and media. These would not have been intended for sharing among a group but would have been restricted to the usage of one individual, or to the usage of a few initiated members of a same group. Thus these attempts cannot be construed as empirical forms of theorism, the purpose of which being the propagation of concepts and not cryptic usage for the benefit of one or of a few isolated individuals. However, this might have contributed to the development of the concept.

Fig. 1. Ishango bone, obv. and rev., from the Congo. Photograph by the Science Museum, Brussels.

1.1 The setting

Some of the early inhabitants of southern Mesopotamia would have been migrants adding to the autochthonous and probably mainly Semitic population. There, they became agriculturists, raised cattle having landed at the right place at the right time and with the right circumstances of their development. Old nomadic endogamy was replaced by new sedentary exogamy which, as a consequence, contributed to the spreading of the male's language and to the assimilation of some of the female's in their own, but also and more importantly, to the assimilation and the spreading of each others' concepts, or to the suppression of one to the advantage of the other at levels which may be partially understood from the iconography of the myth and of the religion as well as from the earliest form of the written word.[3] But it is contended that as soon as common writing systems of numbers, of objects and of ideas were devised and shared by groups, that the necessity of writing down all that surrounded became a compulsion and ended up as the responsibility of a shaman who later rose to scribal status. Taxonomy would have followed fast as it is in the nature of mankind[4] to group similar things together and it is probable that its earliest materialisation consisted in the usage of determinatives common to languages of Mesopotamia as well as Ancient Egypt and others[5]. However Sumerian determinatives which have survived in their original form and later used in Akkadian taxonomy might not alway have served their original intention.[6]

1.2 The problem

When masters ordered their scribes to record the ethereal nature of music they would have been facing one of the greatest problems ever. Counting was in its infancy and theorism was still an elusive concept. Here it is contended that it was stringed instruments which held the key to solving this problem and similarly, it is our observation of the iconography, and of rare extant examplars,[7] which will elucidate the earliest phase of music theory.

1.3 Ancient pipes and flutes

Pipes are tubular structures the purpose of which being the generation of sound. There are two main types of pipes: flute-pipes are blown from the open extremity of a tube, the other being closed or open, and reed-pipes, where the tube is open or closed at one extremity and where the sound is generated by a single or double reeds affixed to one of the extremities. Flute-pipes may have distinctive mouth-pieces, either inserted into or affixed around one extremity; or the end of the tube acts as a mouth-piece. Mouth-pieces can be part of the whole structure or may be removable. The fondamental sound on these instruments is generated by the division of the air-flow by means of a *labium*, or the cutting edge part of the sound generator. The pitches are generated from tone-holes the purpose of which being the lengthening or the shortening of the air column. In the present paper, most blown tubular instruments will be called pipes as it is generally impossible to distinguish one from the other in the absence of mouth-pieces/ends, or of reeds.

The rare depictions of wind instruments in the iconography of the Ancient Near and Middle East, and even rarer extant exemplars, do not allow for any conclusions regarding the quantification of pitch sets. Even had the instrumentarium been prolific, observation and conclusions drawn from it would not have been of any value as minimal variations in the bore of the instrument are consequential to the positioning of the holes and their size, and so is the morphology of the mouth-piece or of the hole through which the instrument is blown. Thus the positioning of holes in ancient pipes and calculations made from the ratios of their position cannot be a reliable method for pitch set quantification. In prehistory, most pipes which have been excavated, such as the conjectural Neanderthalian,[8] (fig. 2) to the Chinese models, are all made from bird, bear, and other animals' bones,[9] or even where in instruments such as the silver pipes of Ur[10] which were made of rolled up silver sheets, uniformity of the bore is difficult to achieve. In order to tune a pipe to a particular pitch set, the holes would have to be re-worked and thus a standard jig, or a pattern for drilling the holes to generate a specific scale is therefore inconceivable. On the Jiahu pipe from China, fig. 3) dating back to around 6000 B.C., two of the holes have additional and smaller ones drilled close to them. They would have been used to correct the pitch which might have been slightly off; but they might also have been used to add modal, or other inflections to a pitch.

Pipe players cannot sing and play at the same time. Therefore aerophones could not have been a solitary musician's accompanying instrument, unlike small lutes, lyres, harps, percussion or idiophones. Rare iconographic instances of aerophones never place wind instruments in polyphonic contexts.[11] Pipes of various nature would not have replicated standard pitch sets but might have been intended for the luring of birds, as has been observed from experiments with replications of the Jiahu flute[12]. It is therefore possible that the aforementioned Neanderthalian model would have been a simple 'three or four-holed bone-duct flute' used for luring birds (fig. 4) within bow-shot, rather than it had been an instrument fitted with holes accurately drilled to produce a pre-defined scale for intentional musical performance - It could have been an implement with a completely different purpose.

Figure 2. Photograph of the fragment of a hypothetical Neaderthal pipe, *ca.* 50.000 BC.

Figure 3. A bone-pipe from Jiahu and detail. *ca.* 6000 BC.

Figure 4. Bone-duct flute for luring birds, from Alkmaar, 13th or 14th century A.D. Length: 7.5 cm, air column: 5.3 cm. (reprinted from Tamboer, A., *Orient-Archäologie, Band 15*).

Figure 5. Isturitz Cave, France (Pays Basque), Magdalenian bone fragment showing perforation and markings. Musée National des Antiquités, St Germain-en-Laye. (Photograph by F. d'Errico) *in* Lawson, Music, Intentionality and Tradition, *Orient-Archäologie*, Band 15. 40.000 to 10.000 years old.

The Isturitz fragment is an Upper Palaeolithic find (fig. 5). It comes from a Magdalenian assemblage of twenty-two musical pipe fragments found at a cave in the Pays Basque of France[13]. It is the richest assemblage ever found. (fig. 6)

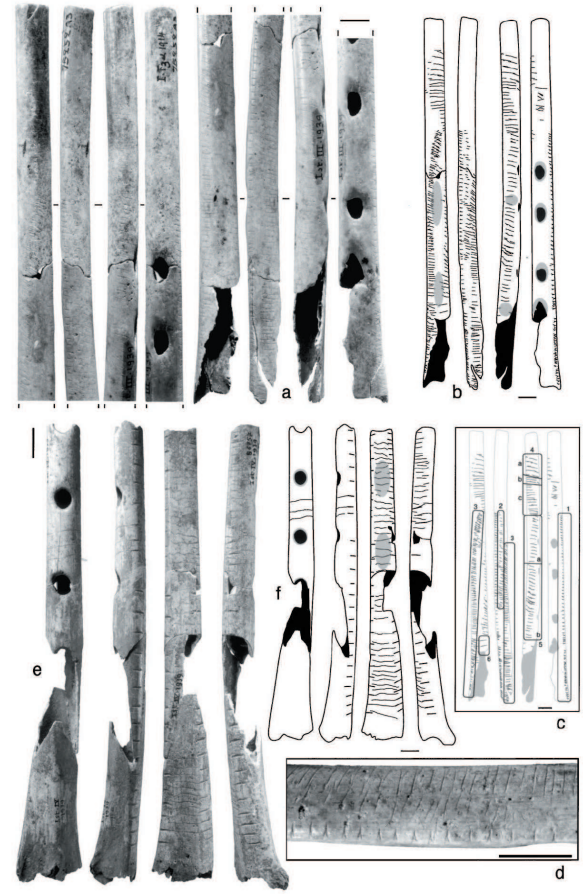


Figure 6. (a, b, e, f) Photo and tracing of the two most complete pipes from the Gravettian levels of Isturitz Cave. Grey areas around the finger holes and at the rear of the pipe indicate concentrations of polish interpreted as use wear; (c) sketch identifying sets of marks made by different tools; (d) close-up view of sets 1–3.

It could be dated from anything between 40.000 and 10.000 years. But are they musical instrument? There are many other possibilities: they could have been devices for mouth-blowing mixtures of air and diluted clay pigments in cave-wall decoration; they could have been needle containers, they could have been ritualistic objects - the list of possibilities is as wide as the imagination.

The markings are most intriguing and would suggest some scaling that might have been used for the positioning of the holes, the part on which they would have been drilled, now missing. The heavy longitudinal marks across the hole resist interpretation.

The number of holes cannot determine the span or the nature of a scale - a three-holed galoubet can play up to two octaves.

1.4 Pan-pipes

These instruments logically predate holed flutes as it is in the nature of mankind to make good usage of what is readily available: It would seems more practical to congregate a number of tubes and adjust their length to specific pitches, rather than drill holes the emplacement of which may not be right and require much empirical adjustment. With pan-pipes, each tube is tuned either by shaving off some of the wood, or bone, from the blowing end or by inserting a substance into the bottom of the pipe thus shortening its speaking length. The substance may be resin, clay, or bitumen, or whatever and where available.

In the absence of textual evidence of their accurate description pipes cannot produce any clues for pitch quantification.

Theoreticians of the Ancient Near and Middle East would have been aware of this difficulty and it is therefore not surprising that there is no evidence of wind instruments in the terminology of theory except for the *embūbum*, Sumerian GI.GÍD[14]. In text CBS 10996[15], *embūbu*[16] appears as an interval of the fifth placed on the third and seventh strings of a hypothetical instrument[17]. The reason for this term being used to name an interval is obscure. It was hypothesised that the *embūbu* was used as 'pitch-pipes', instead of a tuning fork, but this is unsafe unless the *embūbu* had been a double pipe the fundamental open sounds (or others) of which would have sounded

a just fifth and from which all other instruments tuned to the same fifth. However, it is likely that in the course of time the word found another meaning altogether and if not unrelated, at least distantly related to the original meaning. It is also possible that the nomenclatures of strings were mnemonic and used words for their phonetic, metric or other values.

1.5 balaĝ(s), lyres and harps

At the end of the fourth and during the third millennium B.C., large zoomorphic lyres were prominent. (fig. 7) They appeared at royal courts and in religious contexts as revealed in the iconography as well as in the lexical material. According to Krispijn,[18] most of the chordophones listed along with the players, and the songs they accompanied, in the third millennium B.C. are represented with the Sumerian sign balaĝ or compounds of it. It would therefore be reasonable to assume that the boviform lyres would be balaĝ(s) unless the sign represented a generic term for chordophones. Therefore, it is safe to assume that the lyre was either the balaĝ or was a balaĝ, during the late fourth and the third millennium.

However, 'balaĝ' is not a Sumerian word. There is Arabic *balagh* a term which implies tension, as in the tension of a string, and we find a 'bolong' in the Guinea Conakry[19] (fig. 8) which strikingly ressembles two particular Elamite instruments, and one from neighbouring Southern Iraq, (fig. 9) as both types are string, percussion and idiophonic at the same time. This particularity might be the explanation for the sign representing string and percussion at different times and at differing places.

Lyrists would have played to accompany their songs and therefore the sounds of their instruments would have been the replication of the sounds of their voice, as we shall see later. It would be inconceivable that they differed.

Harps and lyres fitted with a greater number of strings would have become paradigms and it appears from texts of theory that the number of nine strings was the favoured span, although there is a first millennium instance attesting of a span of seven strings. There are some Assyriologists and musicologists who are of the opinion that the nine strings listed in UET VII 126 (*Nabnitu XXXII*), and 74, specifically represent strings, and not the pitch set

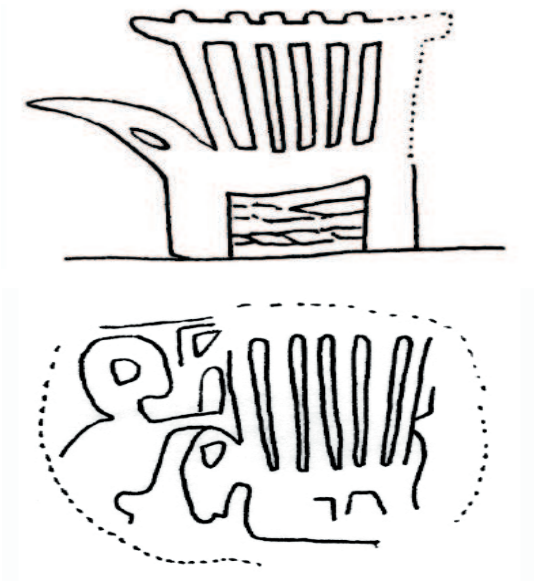


Figure 7. Two zoomorphic lyres from Fara, IVthmillennium B.C.

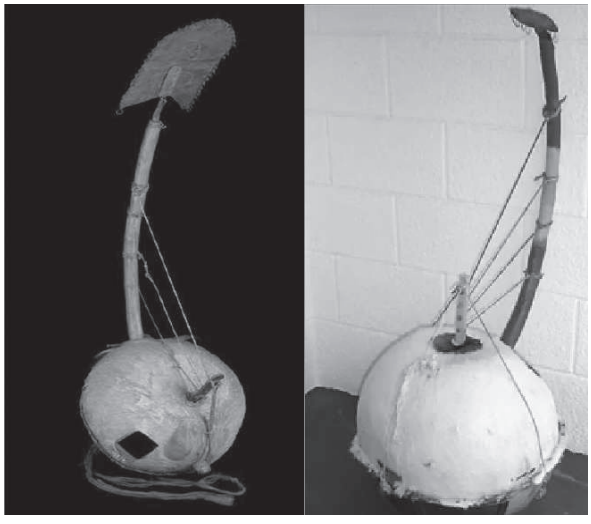


Figure 8. Bolongs from Guinea Conakri.

of a specific instrument and are therefore irrelevant to theory and should remain an organological issue.

However, there is no evidence in any contemporary text that there was segregation between a string and the sound it produced, and why should there be? In a contemporary context, an 'E' string will sound 'E' when tuned to the desired pitch and of course, strings get out of tune, but the primary intention is that they should sound the pitch for which they have been designed and therefore named. The tradition is perpetrated to this day as the names of the strings in most instruments have the name of the pitch they play and in some cases specific names, such as the 'chanterelle'[20] in French,

Figure 9. Elamite and Sumerian (bottom right) balaḫ(s)(?)

for the treble string of instruments, such as the violin, or drone, 'bourdon', in French and 'bordone',[21] in Italian, for bass strings and lowest notes in other instruments. Since there is consistency in associating strings in their position to the pitch they produce, it is difficult to understand that its parallel is not yet fully accepted by so many in the field of Mesopotamian archaeomusicology. When texts, distant from each other by about a millennium give identical nomenclatures, coincidence should be excluded, to the profit of persistence. In UET VII 126 = *nabitnu* XXXII, it is an enneachordal arrangement that is given, an ennead, and in UET VII 74, we have instructions for the constructions of scales from a basic ennead. In both texts there is no ambiguity regarding the number of strings, therefore pitches, and therefore an attempt at extracting out of it hepta or octatonic scales is misguided.

Figure 10. British Museum 1888,0512, diorite, 2400 B.C. - 2200 B.C. Akkadian. Author's photograph.

1.6 Lutes

The lute appears on seal cylinders (figs. 10 and 11) and date from the Akkadian period, about 2334-2000 B.C. However, there is perhaps an earlier occurence from the Uruk period, around 3200-3000 B.C. (fig. 12) The scene depicts a reed boat, typical of the period, in which a seated woman either appears to be playing a lute or holding a paddle. It is difficult to say which it is. However, the character at the bow is holding a punt pole and therefore there is no reason why the woman at the stern should be holding a paddle.

Lutes in early iconographic art eludes from court and temple scenes mainly for the reason that this instrument was mostly associated with Elamite (and other) rural and street playing, with acrobats, bow-legged dwarfs, monkeys and scenes of acrobatic copulation,[22] and consequently did not have court or temple status. It is very possible that in its earliest forms, the instrument was not fretted, that is without either gut ligatures or fret marks to divide the string in order to locate specific pitches of a specific pitch set, but was more of an idiophone accompanying raucous performance, (fig. 13) rhythmically, and probably not melodically.

The occurrence of fretted lutes, extant and in the iconography, infers that luthiers had knowledge of ratios since it is the approportionating of the string with fret marks or of ligatures on the finger-board which determines the location of its pitches. Lutes have a significant advantage over all other stringed instruments as each ot its strings is tuned to whatever interval between each of them is required, probably a fifth for instruments with two strings, g-d, in order to play g-a-b-c on the bass string, and d-e-f-g-a, on the treble string, to generate an enneachord, and fourths for instrument

Figure 11. British Museum 1898,1013.139 cylinder seal, serpentine, 2400 B.C. - 2200 B.C. Akkadian. Author's photograph.

Figure 12. British Museum BM 141632, Uruk period. 3500-3200 B.C. Author's photograph.

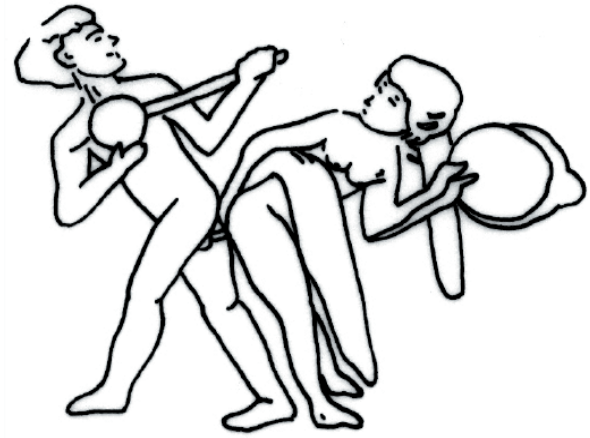


Figure 13. Stamped terracotta from Larsa, 2000-1500 B.C.

with three strings, g-c-f. With harps and lyres, each string must be tuned whatever their number while the lute only requires two or three strings tuned. With the lute, the location of frets in relation to the length of the strings gives ratios of string length. They stand in reciprocal relation to ratios of frequency. Thus it is possible to make accurate quantification for a pitch set from extant instuments, and reasonably good estimations from the iconography.[23]

There is an interesting parallel between tone-hole flutes and lutes, and between pan-pipes and harps. With the latter, each pipe and each string generates its own pitch, and with the former, the pipe and the string divide to produce a series of pitches. It is therefore possible that both tone-hole flutes and lutes developed at the same time, as a consequence of numeracy with the principle of ratios and that therefore pre-literate tone-hole flutes were idiophonic and not devised for a scale based on calculated ratios.

Lutes, therefore, would have been the most suitable instrument for the calculation of musical ratios. However, there is no evidence that they were used for that purpose, possibly because of their connotation with the vulgar rather than the noble.

The only appropriate instrument to illustrate the fundamentals of music could only have been the monumetal lyre, at the end of the fourth, early third millennium, because at that period it was the instrument having the highest status in the instrumentarium, with the largest number of strings. Later, during the Old Babylonian period, *ca.* 1800 B.C., the vertical harp supplanted the lyre, as paradigmatic instrument, since at that period, harps have more strings than lyres. They are also more frequently represented on the iconography. By that time, monumental lyres have vanished. We know this from the iconography and to a limited extent from the archaeology, supported by textual evidence. *Nabnitu* XXXII (U.3011) describes the enneachordal string-plan of a monumental lyre while UET VII, 74, (U. 7/80) describes a nine pitch set construction on an enneachordal harp, and not 're-tuning' to which it is often and erroneously referred. However, *nabnitu* XXXII was written well into the first millennium. Nevertheless it is reasonable to assume from its Sumerian contents and the symmetrical string nomenclature, that it was the copy of a much older treatise, as the string plan of monumental lyres at the end of the fourth, early third millenia, is laid in a fan-like symmetrical disposition reflected in the palindromic nomenclature of the strings in the aforementioned text. It would not have been numbered in this manner had it been taken from the string plan of a harp where the length of the strings is the consequence of a different organological geometry. UET VII, 74, is contemporary with the type of instrument to which it refers, the *sammum*, which, with little doubt but no formal evidence, would have been a harp.

This would have been of critical importance in the developement of theory, as it is the relation between chronology and instrumental typology which has shaped the nature of fundamental theory. Had the relationship been different, the theory too, would have been different, teleologically.

1.7 Conclusion of Part One

This first part has produced the parameters which consitute the infrastructure of theorism. Part two is an epistemological apprehension of music theorism in the Ancient World in relation to the teleology of fundamental theorism, from the analysis of textual, organological and metrological evidence in relation to the neurology of sound perception.

Part Two:
2 The evidence

'It is demonstrable,' said Panglos, teacher of metaphysico-theologo-cosmolonigology, 'that things cannot be otherwise than they are; for as all things have been created for some end, they must necessarily be created for the best end. Observe, for instance, the nose is formed for spectacles; therefore we wear spectacles. The legs are visibly designed for stockings; accordingly we wear stockings. Stones were made to be hewn and to construct castles; therefore my lord has a magnificent castle; for the greatest baron in the province ought to be the best lodged. Swine were intended to be eaten; therefore we eat pork all year round. And they who assert that everything is right, do not express themselves correctly; they should say that everything is best.'
Candide, Voltaire

There are three sources for the evidence: a) The textual and mathematical evidence from cuneiform texts; b) the organological evidence from both extant models and the iconography/ palaeography; c) the neurologic evidence.

a) The cuneiform texts which constitue the essential material for our analysis of music theory are UET VII 126; UET VII 74; CBS 10996 and CBS 1766. There are seconday texts such as N 4782; KAR 158; N3354; BM 65217 + 66616 and MS 5105 in the Schøyen collection, and the Hurrian songs from from Ras al-Shamra to which we shall not refer.

The mathematical evidence comes from four texts from the Temple Library of Nippur, *ca.* 2300 BC.: CBM 11340 + 11402, Obv., and Rev.; CBM 11368 Rev; CBM 11340 + 11402, Rev.; CBM 11902, Obv.; CBM 11097.[24]

b) The organological evidence is from extant instruments suh as the silver lyre of Ur, at the British Museum, London, BM 121199, (U 12354), *ca.* 2500 B.C., from Private Grave (PG) henceforth)/1237, and the Silver Pipes, also from Ur, *ca.* 1450 B.C., from PG/333, at the University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia. From the iconography/ palaeography: (pictographs: ZATU 47, *ca.* 3200 B.C. Harps with three strings: Dumbrill AANE, Pls. 1: 4; 5; 8; 10; 11; 13; 15; 16; 17; 453; 701. Harps with five strings: 19; 21; 22; 23. Harps with seven strings: 34; 176. Balaḫ ?: Pls. 166; 186; 448? Lyres with five strings: Pls. 18; 280; 293; 294; 297; 338; 527. Lyres with eight strings: Pls. 37; 329. Harps with nine strings: Pls. 286; Lutes: Pls. 9; 218; 221; 231; 233; 244; 412.

c) The neurologic evidence comes from two recent publications[25] by Inbal Shapira Lots and Lewi Stone, for the first paper and by Gavin M. Bidelman and Ananthanarayan Krishnan, for the second.

2.1 Cuneiform Texts

UET VII 126: Tuning concept

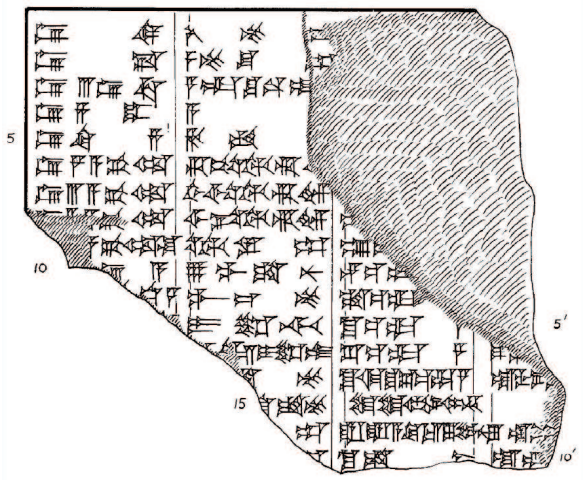


Figure 14. UET VII 126,[26] hand copy by Professor Oliver Gurney, only cols. i and ii are relevant.

UET VII 126 or *Nabitnu* XXXII, (fig. 14) field number U.3011, in the Iraqi museum, is a bilingual text dating from around 800-700 B.C., but would have been the copy of a much older treatise. The left column is Sumerian, the column to its right is Neo- Babylonian.

They translate roughly as follows: front string; next string; third, thin string; fourth, small/ Ea-created-string; fifth string; fourth behind string; third behind string; second behind string; behind string; nine strings.

The set can be simplified as:

(Front) 1 - 2 - 3$^{(thin)}$ - 4$^{'made' by Ea)}$ - 5 - 4 - 3 - 2 - 1 (Back)

It is probable that strings three and four of the front had been modified at some point for a specific reason which will be investigated later. Therefore it is reasonable to assume that the original series would have run as follows:

(Front) 1 - 2 - 3 - 4 - 5 - 4 - 3 - 2 - 1 (Back).

The palindromic arrangement would have been written down as a consequence of a scribe's observation with no knowledge in music theory. There is no evidence of scribes specialisating in music theory in collections.

This arrangement would have originally come from the observation of monumental lyres played by two musicians such as depicted on the Inandīk vase (fig. 15) and in a temple to the Aten in Karnak. (fig. 16) A problem arises, however, in that the Inandīk model dates from around 1600 B.C., and the Karnak type from about 1300 B.C., while I would date the original instrument to the late fourth millennium. Zoomorphic lyres of the late fourth and third millennia iconography are played by single musicians, only. There are few non-zoomorphic monumental lyres. One example is from a Fara seal impression where the lyre is played by one musician. (fig. 17)

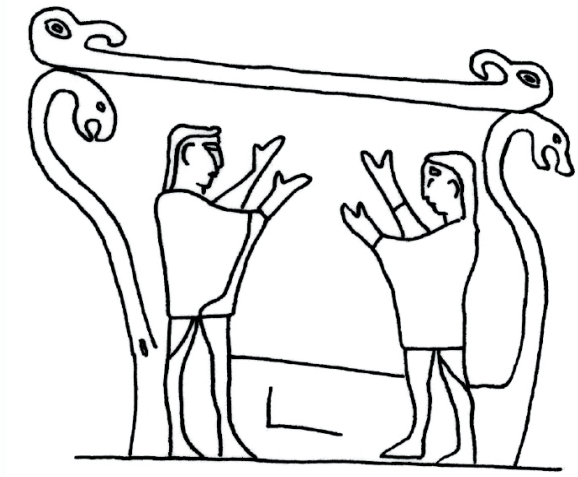


Figure 15. Large asymmetric lyre from the Inandik vase, *ca.* 1600 B.C., AANE, Pl. 516.

Figure 16. Large asymmetric enneachord lyre from Karnak, *ca.* 1300 B.C. (Manniche 54).

The scribe would have looked at the instrument, bridge side. His naming of the strings would have been straighforward. Firstly he would have asked the musician who would have had his own terminology. There would have been a 'front string', and therefore a 'behind string'. It would have been natural to name the front of the instrument the part where the head of the bovid stood; its opposite, the 'behind'. Then it would have been logical to name each of the remaining strings in function of their relationship to the 'front' and to the 'behind', hence, 'first of the front', 'second of the front', 'third of the front', 'fourth of the front'. Naturally, the fifth string is neither of the 'front', nor of the 'behind' and therefore 'string 5' would have defined it adequately. Then, there would have been the, 'fourth of the behind', 'third of the behind', 'second of the behind', and lastly, 'behind string'. Line 10 insists that there are 9 strings, no more, no less.

Strings three and four 'of the front', are further distinguished with qualiyers added to them.

The nomenclature, with qualifiers, as it is inscribed on UET VII 126 was certainly contemporary to its concept, but neither scribe, nor musician would have known from where it stemmed. Similarly, modern musicians do not really know from where the names of the notes come. Practice needs no etymology.

Figure 17. Monumental lyre from a seal impression. Larsa, *ca.* 1300 BC.

The presence of a Sumerian column leads to the assumption that the terms stem from the third millennium and were not a translation of Neo-Babylonian into Sumerian. This is corroborated by an inconsistency in line 4 where the Babylonian

is not a translation of the Sumerian. The Sumerian has: sa.4.tur meaning textually 'string four small' while the Babylonian is *a-ba-nu-[ú* meaning 'made by Ea'. This infers that during the Neo-Babylonian period, and probably earlier, possibly from 2500 B.C., that the string had a special function which was so important that it called for the intervention of god Ea who among other functions, was the god of music.

If this assumption is correct, then it would be safe to assume that the Sumerian column had terms which were known in the third, if not the late third fourth millennium B.C. and that therefore the Sumerian qualifiers 'sig' and 'tur', which are almost synonyms, added to the third and fourth front strings inferred an important distinction.

Sumerian sig is translated as *qatnu* in Old Akkadian onward. The English translation is 'third thin', as it is in the Chicago Assyrian Dictionary: (sa.3 sa.sig = *ša-al-šu qa-a[t-nu]* third, thin string (of the harp[27]) Nabnitu XXXII, i, 3). However, in other contexts, sig translates as *ṣeḫru* = small; *ṣeḫeru,* verb (*ṣaḫāru*), to become small; '*šaplu*' = substantive, low; '*šapliš*' = adverb, on the bottom, below, underneath. Therefore, in terms of organology, *šapliš,* or *šaplu* would be more appropriate as the 'smallness', or the ' thinness' of a string, from visual observation would be difficult to appreciate. This qualification could only result from the musician's defining of the sound of the string as being thin, acoustically, that is 'tinny', 'weak', etc. However sig as '*šaplu',* 'low' and *'šapliš'* = 'bottom' which appears to be more suitable is nevertheless in contradiction with *qatnu,* 'thin' as a thin string has a higher frequency than a 'on the bottom, below, underneath' string, which would be a bass string. So, which had it been bass or treble? The answer to this is probably that the acoustical characteristics of strings three and four would have been difficult to express, in the absence of any theory. Each of these strings would have had different functions, hence the philological distinction of 'sig' and 'tur', that the scribes were unable to distinguish in a musical context. However, an explanation to this will be proposed later in this paper.

In the course of the past four decades, there has been a passionate debate about which part of the instrument is the treble and which is the bass. The question is irrelevant because the disposition is essentially symmetrical. The pitch set is neither ascending nor descending. It ascends or descends from the central string, inconsequently.

The symmetrical arrangement of the strings came from an earlier anhemitonic arrangement: a descending pentatonic scale a-g-f-d-c; and an ascending pentatonic scale g-a-b-d-e, with shared central d. Both combined in this way resulted in enneatonic g-a-b-c-d-e-f-g-a, with a tritone resulting from the conjunction of both pentatonic scales. This is probably how enneatonism was conceptualised.

A span of nine pitches forming a set would have been quite sufficient for playing a wide range of melodies of all types, but it is the introduction of the ≈tritone which was the reason for the introduction of a scale system. This was prompted by the constant necessity for correcting the ≈tritone where ever it was located, but whenever it was corrected, it was simply moved to another set[28].

This correction, or the need for it is illustrated in the string nomenclature. The 'front third thin string' is 'thin' because is does not sound right in relation to its counterpart of the 'behind' as it is tritonic. Now 'front string 4 made, or corrected by the god Ea', infers that the third pitch must be corrected to the pitch of the 4th string in order to correct the tritone to consonnance. This is precisely the method given in UET VII, 74 that we shall discuss later.

Having introduced some terms of theory it is now appropriate to define them, bearing in mind that in its infancy, theory of music would have had no use for them.

There is a fundamental reason why human beings prefer certain intervals to others. Our vocal folds vibrate, generating sound-waves.

These sound-waves are air-borne and travel at a frequency which depends on the atmosphere. As a result, these pitches stand in a just relationship with each other. It is therefore obvious that in turn, the mechanics and the physiology of our ears and of the 'neurons' which carry signals to the cerebral cortex, will respond favourably to the sounds produced by our own vocal folds, hence my quotation of Voltaire's Candide.

Some musicologists[29] are of the opinion that music does not need pitches standing in fixed relationships and perceived as scales made up from

a fixed tuning, I will argue, contrarily, that music, without any doubt, needs pitches as there is no music without them. Pitches need to stand in fixed relationships with one another otherwise they would not be perceived pleasantly, and if they do not need to be perceived as scales and do not need to be fixed by natural tuning it is because the cerebral cortex of our brains is already attuned to pitches standing in just relationship to each other.

2.2 The heptatonic myth

Some are of the opinion that heptatonism and the octave are natural phenomena and ignore humankind's natural propensity for just intonation.

Heptatonism is artificial. Its construction which results from the alternation of fifths and fourths, or reciprocally, can only exist within an octavial limitation brought up when mathematics first interferred with music. Thus it is improper to qualify any music as heptatonic unless there is unequivocal evidence for its construction and its inclusion within an octave.

Heptatonism can only exist in relation to the octave because without this limitation, the alternation of fifths and fourths could go on endlessly. (fig. 18) Thus the last pitch of the seventh step of alternation lands one semi-tone higher than the first one giving a 'false octave'. This is where the sequence ends because this problem could not be solved. (fig. 19) In the absence of the octave, heptatonism is elusive.

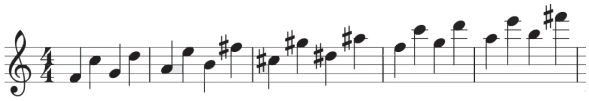


Figure 18. Sequence of alternating fifths and fourths unlimited by the octavial framework.

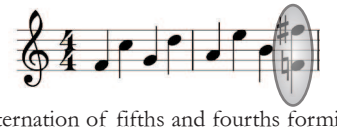


Figure 19. Alternation of fifths and fourths forming an heptatonic scale consequence of the octave.

It is therefore illogical to suggest, as Hagel puts it, o*bscurum per obscurius*, that: '*...All the 'tunings' and 'scales' we are dealing with here (Ancient near-East and Ancient Greece) are heptatonic. Even if they are not strictly heptatonic.*'

Even in Ancient Greece, the concept of heptatonism was never clearly defined, at least from the literature. The only evidence of its construction by means of alternation of fifths and fourths, would come from a late translation (12th A.D.) of Euclid's Division of the canon.[30] In Timaeus, Plato constructed the Pythagorean tetrachords from his first tone, D, and going up two 9 /8 tones to E and his chromatic F#, which then stands in 243 /256 ratio to his diatonic G, which was the tone already produced as the harmonic mean of D and D'. But there is no evidence, in this text, of alternation of fifths and fourth. (fig. 20)

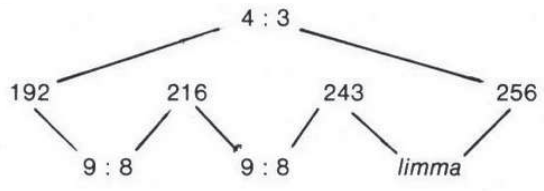


Figure 20. Plato's construction of the tetrachord in Timaeus.

Greece has no texts of theory which have survived from their Ancient History. All we have comes from copies of copies, translations of copies, copies of translations, all in languages ranging from the Syriac to the Arabic, the Farsi, Latin and finally re-written in a 19th century form of Classical Greek.[31] It is therefore presumptuous to claim that the heptatonic construction based on the alternation of fifths and fourths, which anyway is only 'presupposed' in *Timaeus*, to quote West, but which is taken as fact by some, is wishfull thinking. I his XVIIIth theorem of the Κατατομὴ κανόνος, Euclid writes: '... from B, tune a fifth down: Z, Z-D will be a tone. From Z, tune up a fourth to E. The interval BE will therefore be a tone and so will be G-E. Thus the interval they have in comon is D-G; Z-G will therefore be equal to D-E; Z-E is a fourth.' This is hardly proof of a tuning based on alternating fifths and fourths amounting to a heptatonic scale.

Pitch quantification will settle the argumentation. Babylonian enneatonic scale of *pītum*[32] compared to the Pythagorean hypodorian octave species gives the following figues, 'a' for Babylonian and 'b' for Greek. (fig. 21)

a	576	640	720	768	864	960	1037*	1152	1296
b	576	648	729	768	864	972	1024	1152	

Figure 21. 'a', Babylonian figures muliplied by 16 to match 'b' Greek quantification. Note that 1037* = 1036.8

2.3 Just intonation reality

A melody is a congregation of pitches. Their collation amounts to a pitch pool. The order in which the pitches of the pool can be organised, in an ascending or descending order, constitutes a pitch set. Scales are the consequence of the transposition on instruments of the pitches of the voice as the human voice is – as a consequence of its anatomy and physiology – naturally equipped with a propensity for just intonation. (In the course of time, modifications, adaptations, etc., of certain fixed pitches has and will occur, but this belongs to the scope of modality that will discussed later.)

The principle of theorism comes from the conceptualisation of tuning systems for string instruments in replication of the just intonation of the human voice. Since the original method introduced basic metrology, it is evident that theory became a matter for the mathematician and thus the dawn of theory was further distorted by early mathematics.

At the dawn of music theory, the most consonantal intervals would have been just fifths and just thirds, minor and major, in the following order: initial, descending minor third, descending major third, expressed from the ratios 6/6; 6/5; 5/4 with the just fifth 6/4 = 3/2. (Here, I would like to introduce ethnomusicology where it is found that the most primitive forms of music have a propensity for fifths and thirds, as I have discussed in a recent ICONEA seminar on the Psychogenesis of Music Theory.)[33]

The evidence for this prototypical tuning method is given in text CBS 10996, (fig. 22) which although written during the first millennium, would have been the description of a much older concept, probably from the first part of the third millennium. This text is unequivocal. Only fifths (6:4), minor thirds (6/5) and major thirds (5/4) are listed.[34]

2.4 Babylonian tuning

Babylonian tuning would have been approximative because string-instrument making during the early third millennium was not sufficiently developed to allow for optimal sound quality. It must also be reminded that tuning is the musician's task and not the theoretician's. Therefore theory would have had no say in it, only the musician's ear would have mattered. There is no textual evidence for the method consisting in sounding the two opposite degrees of dyads. Therefore we may not assume that the technique had been known. With modern instruments having good sound sustaining, such as the guitar, for instance, the two opposite strings of a fifth are plucked simultaneously, and one or the other is tuned until the frequency of the beats slows down until no longer perceptible. From my own experience with instrument reconstruction, especially with the silver lyre of Ur, the sustaining, while sufficiently long to allow for tuning in this manner, there is no evidence that they used this technique. Babylonians would have played their strings, singing along and tuned them to their voices.

Figure 22. CBS 10996.

The generation of beats arising from 'un-just' intervals was a phenomenon ignored by theoreticians because these beats, had they heard them, had no purpose in their calculations. The intervals they wrote down were 'sound-less', obviously, and the 'justness' of intervals produced from the experimental monochord was achieved by means of rulers and mobile bridges, or measurements marked alongside the instrument. Music theoreticians were mostly tone deaf, being the reason why they needed mathematics to express what they could not hear.

Therefore there would be no reason why the boviform lyre of the early third millennium would have been tuned with intervals other that just fifths and thirds. It goes without saying that musicians would not have thought of them in terms of ratios. For them tuning came spontaneously.

UET VII 126, (fig. 14) suggests a tuning which consisted in two conjunct fifths within which

just thirds were placed. (figs. 23-24)

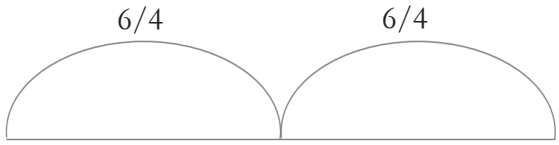


Figure 23.

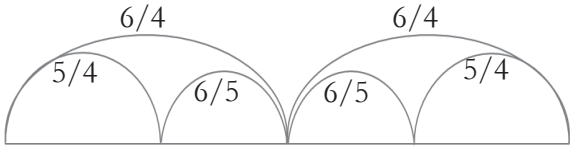


Figure 24.

On the basis of the principle of symmetry which is clearly demonstrated in the nomenclature of UET VII, 126, the arrangement of unaltered pitches would be:

g - b - d - f - a

In ascending or descending order, as has been discussed earlier.

Now comes the argument as to the nature of the pitches in between thirds. How were they tuned?

The postulation generally held by most of my colleagues that what they call dyads or dichords, referring to the intervals in CBS 10996, are empty, is flawed.[35] The evidence is that they must be filled. It is common knowledge that whenever learning intervals, or whenever we wish to explain their nature to students, we sing all of their internal degrees, because it is important to locate semitones for scalar identification. (I use here the term scalar in order not to enter in a debate about tonality and modality which would confuse matters, even more.) When an interval is empty, it has lost its scalar identity. For instance, without knowing within which scale fifths are located, all of them will be just. Within a heptatonic scale system, 6 out of seven fifths will be just.

Regarding thirds, all will be just, four of them minor, and four of them major. However, in the absence of a system of scales, for which we have evidence only in the Old Babylonian period, the nature of fifths and thirds will solely depend on their content. It would be astonishing that in the course of the development of theory, this principle changed.

2.5 Cuneiform Texts

UET VII 74: The concept of scale systems

We have seen that the concept of tuning came from the transposition of voice pitches onto a suitable instrument, probably a boviform lyre, from the late fourth early third millennium and probably well into the first millennium. The concept of a scale system came as soon as the pitches of a set became identifiable as a result of their nomenclature, though tuning. Text UET VII, 74, (fig. 25) dating about 1800 B.C. illustrates this concept, enneatonically.

This text has erroneously been labelled a tuning, or re-tuning text.[36] It is neither a tuning text because the instructions are not for tuning; nor is it a re-tuning text because the instructions are not for re-tuning. The text is about scale construction on an instrument which has already been tuned.

It is now appropriate to discuss the consequences of various tuning methods.

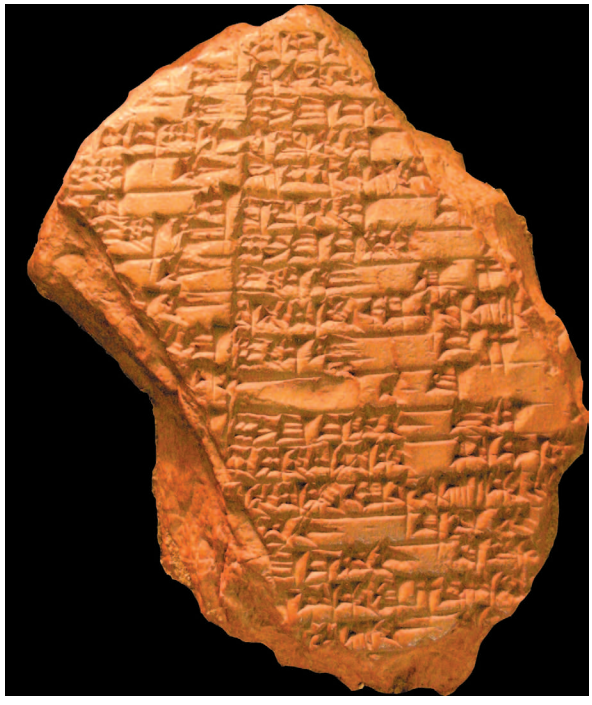


Figure 25. Cast of the original tablet. Author's photograph.

There are many ways in which an instrument can be tuned.

The various methods will determine the nature of the scale which results, and therefore of

the scale system generated from it. For instance, should we tune alternating fifths and fourth in one octave, we end up with a Pythagorean heptatonic scale, good for monodic music but totally unsuitable for harmony; should we tune in just fifths and just thirds, we end up with an enneatonic scale excellent for monody but unsuitable for harmony. Should we tune in variable thirds, slightly smaller fifths and slightly larger fourths, as for a modern piano, we end up with equal temperament, good for harmony but poor for monodic music. Each method was and is related to time, space and purpose, but it is logically obvious that the just fifths and just thirds method, the evidence of which we have with UET VII, 126 and CBS 10996, was used in the Ancient Near East, up to the first millennium, naturally excluding heptatonism.

Once the initial tuning completed, the building up of scales can start. There are two methods. Firstly the dynamic and secondly, the thetic methods. The dynamic method consists in staring a scale on each of the pitches of the generative scale, *i.e.*, that is the scale which resulted from the initial tuning. There is no evidence that this was used other than in theoretical works because it would place the top scales at impractical pitches for singers. The thetic method consists in moving the semitone(s) within the generative scale, to another location thus generating another scale. The two methods produce identical systems. However, the dynamic (fig. 26) demands a greater number of strings while the latter operates within an original span.

This system was in usage in the Old Babylonian period, around 1800 B.C., but while the method remainded thetical, it operated differently. While it displaced the semitone(s), this was done with a different concept.

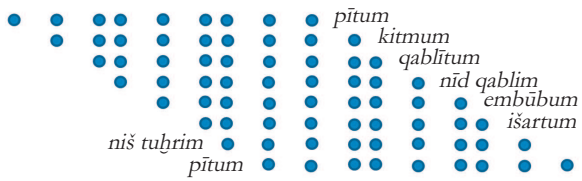


Figure 26.

The thetical method described above (fig. 27) proves that the concept of the octave was unknown during the Old Babylonian period. Had it been, then they would have build up their scales within the octavial heptachordal span:

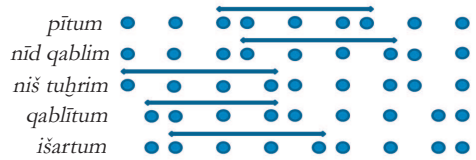


Figure 27.

only seven strings/pitches would have been mentioned because this is all that was needed. Some will argue that the text was devised for the construction of heptatonic scales adapted to an enneachordal instrument. This is not a satisfactory proposition because there were instruments at that time with a varying numbers of strings and therefore, had music been heptatonic then the heptachordal paradigm would have been the standard. There is consistency in the few second and first millennium texts in naming nine strings, except in CBS 1766 that we shall discuss later, and CBS 10996, which is evidently the reduction to the heptachord of a series of intervals spreading over a span of 13 degrees, amounting to three just fifths.[37] It remains that we have consistency in the nomenclature of nine string/pitches over at least a thousand years. Had tuning or system constructions been intended for instruments of varying numbers of string, then it would have been astonishingly coincidental that only nomenclatures of nine strings survived.

Over the past years it has been generally accepted that from UET VII, 74, seven scales could be extrapolated and an eighth landing a semitone higher or lower than from where it started, depending on which chapter of the text. However, The term *pītum* means 'opening' in Akkadian and is also the scale with which the text starts in its present condition. The hypothesis that there were two chapters on the tablet each with eight modes would have resulted in an unreasonably large tablet for the Old Babylonian period, unless of course, the text had been spread on a series of normal sized tablets. However, for a text of that importance, it would be possible that it had been written all on one tablet and that therefore there were only 4 scales in each chapter with a central scale, *išartum*, a total of 5 scales. This argument is critically reinforced, confusing heptatonicists even further, because should there be only 5 enneatonic scales, then each could host 3 heptatonic or 2 octatonic making the current reconstruction of the text pointless.

2.6 The enneatonic reformation

This reformation, initially coined by my colleague and friend Leon Crickmore, is the consequence of mathematics. The science led the way to Babylonian heptatonism in the first millennium. I contend that this took place as soon as mathematicians took over from empirical theoreticians, and explored ratios of string length. Empirical theoreticians, who were nothing more than observant scribes, only noted string lengths, but did not appreciate them as ratios. I am of the opinion that god numbers appearing during the Babylonian period would have been used as standards for many measurements and probably also for musical metrology. Anu was the god of 60. This would have been the length of a lute string of 60 *ubanātu*, or fingers, about 96 centimetres; Enlil at 50 would locate the first fret; Ea, 50, the third fret and Sin, 30, the fourth fret. Ea was also known as the god of 2/3 which reinforces the hypothesis. This would set the tonal framework: Fundamental = 6/6; a descending minor third, at 6:5, a descending major third at 5:4, therefore a descending fifth of 6:4 (=3/2) and the octave at 6/3 (=2/1). Intermediate pitches would be set by ear, probably in a 'pseudo modal' context that we shall explore later.

Then, around 2300 B.C., Nippur mathematicians produced various mathematical tables.[38] Four of them, among thousands, excavated at the Temple Library of Nippur were hand-copied transliterated and translated by Hilprecht and published in 1906. Their collation produced a list of numbers, notably from 36 to 80, as follows: 36; 40; 45; 48; 54; 60; 64; 72; 80. The relationship these numbers have between each other expresses just intervals of an enneatonic pitch set. There are two additional numbers, 81, and 50. 81/80[39] is the syntonic comma and 50/48 is the small semi-tone. This probably the reason for their presence in the tables, and also because their are regular numbers expressing just intervals.

Comparing these numbers to the previous quantification given previously in this paper, shows that at that time, there had been some reformation of pitch quantification: (fig. 28)

a	36	40	45	48	54	60	64.8	72	81
b	36	40	45	48	54	60	64	72	80

Figure 28.

Row 'a' is the old system, probably Sumerian (which would not have been used until around 2300 B.C.) and row 'b' which is the reformed system, dating around 2300 B.C. where we have two types of tones: 9/8, the major tone and 10/9, which is the minor tone of just intonation; and a just semi-tone of 16/15.

A tuning for this system would have included just fourths, and as a consequence the introduction of a Pythagorean minor third: 64/54 = 294.135 cents. An acute fourth was also introduced: 54/40 = 520 cents. However, this tuning was not an ascending, or a descending alternation of fifths and fourths, but a projection of fifths and fourths from the central note, 'd' as shows below (fig. 29):

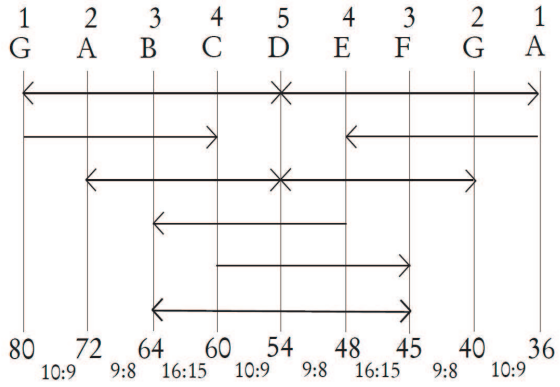


Figure 29.

Mathematicians had taken control over from theoretical empiricism. It would not take long before they discovered the octave. There is yet no term for it in the philology, or would there be one, it would have escaped our perspicacity. However, it is implied in the ratio of god Anu to Sin: 6/3 = 2/1, but this does not consitute evidence that they would have used it in relation to heptatonical construction or otherwise.

The textual evidence expresses the confusion that was brought along when mathematics clashed with the empirical theory of scribes or musicians. The symmetrical system in which they had found perfection was proven less than perfect with mathematics, especially with 64.8 which did not fit in the greatest scheme of justness but was in a way undeniable

proof of an evil and inexplicable dissonance as the ratio of 64.8/45 is 631 cents, not quite a tritone, but an acute diminished fifth, but certainly a dissonant interval. This shows how hemitonism proved a difficult concept compared to the simplicity of anhemitonism where dissonance is unknown.

2.4 The advent of heptatonism

Heptatonism is a mathematical concept, irrelevant to music practice and which theoreticians spread around liberally whenever they need to categorize music which is not pentatonic. It is a bit like archaeologists having just dug out an unidentifiable object which will eventually end up in a museum as 'cultic'.

The definition given by Wikipedia makes of it a form of universal panacea where, I quote, are included the major scale; the melodic minor; ascending and descending harmonic, minor and major; Byzantine; Hungarian; Gypsy; Egyptian; Heptonia Prima and Secunda; Heptonia Tertia; Verdi's Scala Enigmatica; Melakarta; Thaat; Chinese Gongche notation, etc.

There is a need for a definition as a number of seven pitches that can be included within an octave does not necessarilly mean that the scale is heptatonic since the set might well spread beyond, or below the octavial incarceration.

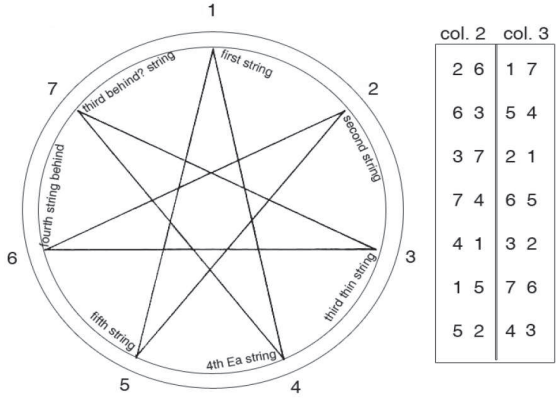
While theoreticians of modern music might wish to establish their own definition of the term, I should like to preconize a definition suitable to its construction in Antiquity inasmuch as it differs from other scale constructions.

Once more, as it has been the case during the argumentation in this paper, textual evidence is the basis for definition. With heptatonism, it is text CBS 1766 (fig. 30) which constitures the evidence. It was bought among the Khabazu acquisitions, by the University Museum of the University of Pennsylvania, and may have originated from Sippar. It is difficult to date the text because its archaeological context is unknown. However, on the basis of its contents and of the illustration it has, I would date it around the turn of the first millennium, that is 1000 to 700 B.C. The text has a header to a table that Jerome Coburn[40] has attempeted at reading with interesting conclusions that shall not be discussed here.

Figure 30.

Early in June 2007, Caroline Waerzeggers and Ronny Siebes[41] from the Vrije Universiteit in Amsterdam proposed an alternative interpretation to a paper published by Wayne Horowitz, of the Hebrew University, in the Journal of the Ancient Near Eastern Society[42]. It was originally published by Hilprecht over one hundred years ago in his Explorations in Bible Lands During the 19th Century.[43] This volume included a photograph of the inscribed side with the label: 'Astronomical Tablet from the Temple Library'.

The tablet is divided in two sections. (fig. 31) The first section, at the top left consists of a heptagram[44] with annotations, inscribed within two concentric circles. The second section, below the heptagram, is a table with 11 columns of which the first is empty, with traces. Columns two and three are inscribed with two lists of seven numbers each; column four is empty without any traces; and columns five, six and seven are inscribed with only one line of numbers. A header spreads along the whole length of the columns; column 11 has traces of terms.



col. 2	col. 3
2 6	1 7
6 3	5 4
3 7	2 1
7 4	6 5
4 1	3 2
1 5	7 6
5 2	4 3

Figure 31.

The readings of the first two columns to the left of the table and the nomenclature of the heptagram are undisputed and yield, it is contended, the essential of what the text has to offer. However, we shall only consider the heptagram and the figures in column two since they are essential to the argument.

2.5 The heptagram and heptatonism

Any musicologist presented with a heptagram would conclude that the figure is a diagrammatic explanation for the formation of the heptatonic diatonic musical scale. They would expect to find numbers, notes, pitches or degrees on each of the points of the star, starting at the top, and then explain that the intersecting lines linking the numbers would describe the alternation of intervals of fifths and fourths which are the basis for the formation of the heptatonic paradigm. Should they wish to illustrate further the principle, they would draw a table with a series of numbers which would flow in the following sequence: 1-5-2-6-3-7-4-1, as a complementary explanation of how the heptagonal construction works.

Should they substitute notes for numbers, as they are displayed on the circumference, clockwise, then the notes could be any ascending or descending series starting on any note of the heptatonic scale: c-d-e-f-g-a, or b.

It is therefore unsurprising that the names and numbers which appear on the heptagon in CBS1766 are precisely what our music theoretician would have said, without hesitation, about a similar pattern. Indeed, the number at the top of the heptagon is 1 and its nomenclature is *qú-ud-mu*, meaning the first string, unsurprisingly. The orthography diverges from UET VII 126. There we have Sumerian sa.di with Akkadian equation *qud-mu-u[m]*. The second term, clockwise, is headed with number 2 followed by *sa-mu-šum*, close enough to *sa-mu-šu-um* in the same UET; the term which follows is not readable but it must have been *šal-al-šu qa-at-nu* since this is what follows in our text of reference; then we have *a-banu* rightly followed by *ḫa-an-šu* and *re-bi? úḫ-ri*. The sequence ends with number 7, *šal-šu* [XX]. The last signs resist reading but we would expect something expressing that it was the 'xth behind-string', *i.e.*, the 'xth last string' as we have it in UET VII 126. Now, that the numbers in the table are substituted for the names of the strings on the heptagram is of high significance as this constitutes the first instance in the history of music of a dichotomy between the string itself and the sound it produces. The string is called 'x' but its value is '1', therefore it could also be '2', '3' or whatever number of degrees they had in their scale, in this case, up to degree '7'.

This proves that they would, by now, have distinguished the dynamic from the thetic disposition.

The second column, which includes two descending series of numbers, can be interpreted as follows: Firstly, we may read the first series, from top to bottom as 2-6-3-7-4-1-5, or twin it, in horizontal reading, with the second series: 6-3-7-4-1-5-2 and read it this way: [2-6/6-3][3-7/7-4][7-4/4-1][1-5/5-2]. In both cases, we end up with the same construction.

This text proves beyond possible doubt that a) the concept of a genuine heptatonic construction resulting from alternation of fifths and fourths was known in the first millennium B.C.; b) that the enneatonic pitch set was now reduced to the heptatonic; c) that the dynamic disposition was by now preferred to the thetic disposition; d) that numbers were now used to indicate the relative position of scales in the system. Hence they would have had the scale of the first degree, of the second, of the third, etc.

This proof of heptatonism will further support the nature of the previous enneatonic construction which was itself the consequence of an anhemitonic, probably pentatonic ancestor. While all previous texts discussed in the present paper are enneatonic with traces of anhemitonism, CBS 1766 is archetypical of heptatonism where no more traces of either penta- or enneatonism survive. Thus the construction that Hellenists had wishfully thought that it belonged to Greek theory, emerged from the sands of Mesopotamia rather than from the shores of Greece. It is therefore highly probable that the Greeks 'acquired' the principle of heptatonism during the Orientalizing Period[45] in the later part of the 8th century B.C. When the Pythagorean School developed, all had been forgotten of its Eastern origins.

Part three
3 Neurologic evidence

Two recent studies: a) *Perception of musical consonance and dissonance: an outcome of neural synchronisation,* by Inbal Shapira Lots and Lewi Stone, Biomathematics Unit, Faculty of Life Sciences, Tel Aviv University, Israel, 2008, and b) *Neural Correlates of Consonnance, and the Hierarchy of Musical Pitch in the Human Brainstem*, by Gavin M. Bidelman and Ananthanarayan Krishnan, of the Department of Speech Language, Purdue University, USA, 2009, have discussed the preference for consonantal intervals.

Both teams have been mislead by the Pythagorean dictate. Therefore the nature of the intervals they analysed are not really representative of the hierarchy of just or natural ratios defined in the Ancient Near East. However, I have chosen to include their conclusions in the present paper on the basis that they support my hypothesis of human kind's production of sound and therefore preference for natural intervals, from which early theories developed, as I have explained in this paper. This shows that the postulation held by most musicologists that all known systems in the Ancient Near East are heptatonic is flawed.

A number of theories have been proposed as to why consonance is related to simple frequency ratios. Lots and Stone have explored the theory of synchronisation properties of ensembles of coupled neural oscillators to demonstrate why simple frequency ratios may have achieved a special status and why they are important for music perception.

The analysis shows that mode-locked states ordering give precisely the standard ordering of consonance as given in Western music theory. The results show the importance of neural synchrony in musical perception. Having presented a theory of consonance and dissonance, it is important to emphasize that the effects described are intended to deal solely with just intervals outside of any musical context in order to exclude emotional components such as harmonic progressions. Thus, jazz, or other dissonances falls outside the scope of this theory. The model serves to explain why human preference for simple frequency ratios in pure tones may be a natural consequence of neural synchronization.

Bidelman and Krishnan argue that consonnantal and dissonantal pitch relationships are the fondamentals of Western music. They hypothesize that phase-locked neural activity within the brainstem may preserve information relevant to these important perceptual attributes of music. To this end, they measured brainstem frequency-following responses from non musicians in response to the dichotic presentation of nine musical intervals varying in their degree of consonance and dissonance. Neural pitch salience was computed for each response using temporally based autocorrelation and harmonic pitch sieve analyses. Brainstem responses to consonant intervals were more robust and yielded stronger pitch salience than those to dissonant intervals. In addition, the ordering of neural pitch salience across musical intervals followed the hierarchical arrangement of pitch stipulated by Western music theory. Finally, pitch salience derived from neural data showed high correspondence with behavioral consonance judgments.

These results suggest that brainstem neural mechanisms mediating pitch processing show preferential encoding of consonantal musical relationships and, furthermore, preserve the hierarchical pitch relationships found in music, even for individuals without formal musical training. It was inferred that the basic pitch relationships governing music may be rooted in low-level sensory processing and that an encoding scheme which favours consonantal pitch relationships may be one reason why these intervals are preferred.

Interval	Musical pitches	No. of semitones	Ratio of fundamentals	Frequency components (Hz)
Unison (Un)	**A3, A3**	**0**	**1:1**	Note 1: ***220, 440, 660, 880, 1100, 1320***
				Note 2: ***220, 440, 660, 880, 1100, 1320***
Minor 2nd (m2)	A3, B♭3	1	16:15	220, 440, 660, 880, 1100, 1320
				235, 470, 705, 940, 1175, 1410
Major 3rd (M3)	**A3, C#4**	**4**	**5:4**	**220, 440, 660, 880, *1100*, 1320**
				275, 550, 825, *1100*, 1375, 1650
Perfect 4th (P4)	**A3, D4**	**5**	**4:3**	**220, 440, 660, 880, 1100, 1320**
				293, 586, 879, 1172, 1465, 1758
Tritone (TT)	A3, D#4	6	45:32	220, 440, 660, 880, 1100, 1320
				309, 618, 927, 1236, 1545, 1854
Perfect 5th (P5)	**A3, E4**	**7**	**3:2**	**220, 440, *660*, 880, 1100, *1320***
				330, *660*, 990, *1320*, 1650, 1980
Major 6th (M6)	**A3, F#4**	**9**	**5:3**	**220, 440, 660, 880, 1100, 1320**
				367, 734, 1101, 1468, 1835, 2202
Major 7th (M7)	A3, G#4	11	15:8	220, 440, 660, 880, 1100, 1320
				413, 826, 1239, 1652, 2065, 2478
Octave (Oct)	**A3, A4**	**12**	**2:1**	**220, *440*, 660, *880*, 1100, *1320***
				***440, 880, 1320*, 1760, 2200, 2640**

Table 1. Musical interval stimuli used to evoke brainstem responses. Values in italics represent frequency components shared between both notes in a given dyad. Intervals in bold were taken are consonnantal by the authors; intervals in lightface were taken as dissonant by the authors. Harmonics of individual notes were calculated from the ratio of their fundamental frequencies in just intonation. (Gavin M. Bidelman and Ananthanarayan Krishnan)

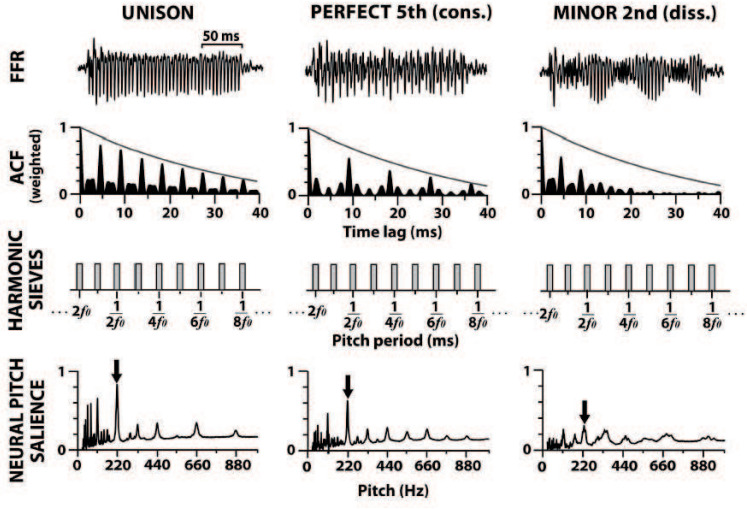


Table 2. Procedure for computing neural pitch salience from FFR (frequency-following response) responses to musical intervals [unison, perfect fifth (consonant), and minor second (dissonant) shown here]. Dichotic presentation of a musical dyad elicits the scalp-recorded FFR response (top row). From each FFR waveform, the autocorrelation function (ACF) is computed and time weighted with a decaying exponential (solid gray line) to calculate the behaviourally relevant periodicities present in the response (second row). Each ACF is then passed through a series of harmonic interval pitch sieves consisting of 'windows' centered at f0 and its integer harmonics (third row). Each sieve template represents a single pitch and the magnitude of the output of each individual sieve represents a measure of neural pitch salience at that pitch. Analyzing the outputs across all possible pitches (25–1000 Hz) results in a running pitch salience for the stimulus (fourth row). As the arrows indicate, the magnitude of pitch salience for a consonant musical interval is more robust than that of a dissonant musical interval (*e.g.*, compare perfect fifth to minor second). Yet, neither interval produces stronger neural pitch salience than the unison. (Gavin M. Bidelman and Ananthanarayan Krishnan)

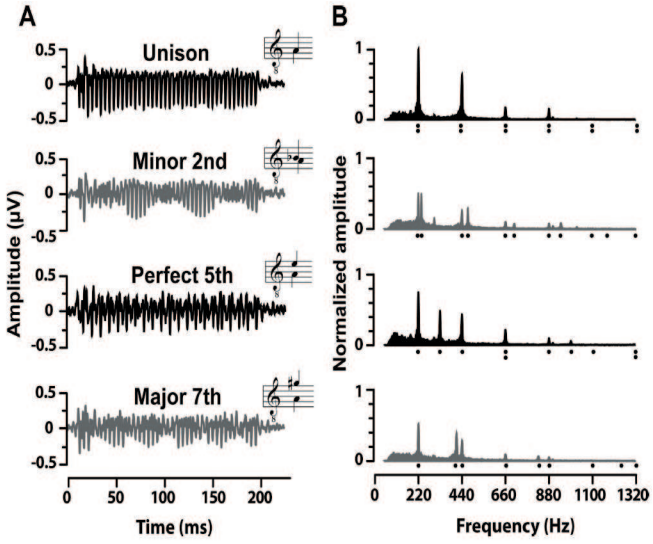


Table 3. Grand-average FFR waveforms (A) and their corresponding frequency spectra (B) elicited from the dichotic presentation of four representative musical intervals. Consonant intervals are shown in black, dissonant intervals in gray. A, Time waveforms reveal clearer periodicity and more robust amplitudes for consonant intervals than dissonant intervals. In addition, dissonant dyads (*e.g.*, minor second and major seventh) show significant interaction of frequency components as evident from the modulated nature of their waveforms. Insets show the musical notation for the input stimulus. B, Frequency spectra reveal that FFRs faithfully preserve the harmonic constituents of both musical notes even though they were presented separately between the two ears (compare response spectrum, filled area, to stimulus spectrum, harmonic locations denoted by dots). Consonant intervals have higher spectral magnitudes across harmonics than dissonant intervals. All amplitudes are normalized relative to the unison. (Gavin M. Bidelman and Ananthanarayan Krishnan)

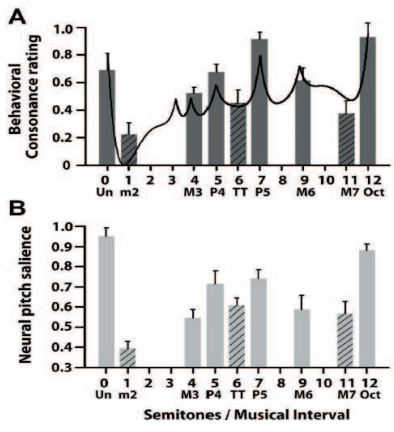


Table 4. Perceptual consonant ratings of musical intervals and estimates of neural pitch salience derived from their respective FFRs. Solid bars, Consonant intervals; hatched bars, dissonant intervals. A, Mean behavioral consonance ratings for dichotic presentation of nine musical intervals. Dyads considered consonant according to music theory (solid bars) are preferred over those considered dissonant [minor second (m2), tritone (TT), major seventh (M7)]. For comparison, the solid line shows predictions from a mathematical model of consonance and dissonance (Sethares, 1993) in which local maxima denote higher degrees of consonance than minima, which denote dissonance. B, Mean neural pitch salience derived from FFR responses to dichotic musical intervals. Consonant intervals produce greater pitch salience than dissonant intervals. Even among intervals common to a single class (e.g., all consonant intervals) FFRs show differential encoding resulting in the hierarchical arrangement of pitch described by Western music theory. Error bars indicate one SEM. (Gavin M. Bidelman and Ananthanarayan Krishnan)

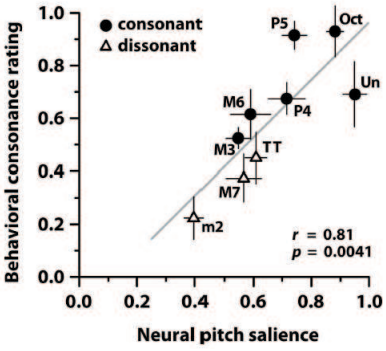


Table 5. Neural pitch salience derived from FFRs versus behavioral consonance ratings. Consonant intervals elicit a larger neural pitch salience than dissonant intervals and are judged more pleasant by the listener. Note the systematic clustering of consonant and dissonant intervals and the maximal separation of the unison (most consonant interval) from the minor second (most dissonant interval). Error bars indicate one SEM in either the behavioral or neural dimension, respectively. (Gavin M. Bidelman and Ananthanarayan Krishnan)

General conclusion

This paper will have suffiently shown that heptatonism did not appear spontaneously on the musical scene of the Ancient Near East. The textual evidence is unimbiguous as there are no traces of any heptatonic construction before the first millennium B.C.

Neural correlates of consonnace and dissonance in the human braistem will have proven to musicologists that heptatonism being the result of mathematical interference in the justness of natural tuning, is artificial and that therefore the universal reference to it in comparative musicology is misguided.

On the other hand, textual evidence shows empirical methods which led from anhemitonism to enneatonic diatonism. During the second millennium there is evidence of a struggle between old and new systems as the old enneatonism built uniquely on just fifths and thirds had flaws. This was partially solved by an intermediate system where enneatonism made its way to proto heptatonism. Then all was finally resolved in the first millennium where we have for the first time evidence of a heptatonic construction made from the alternation of fifths and fourths, unequivovally and strictly limited to the heptad.

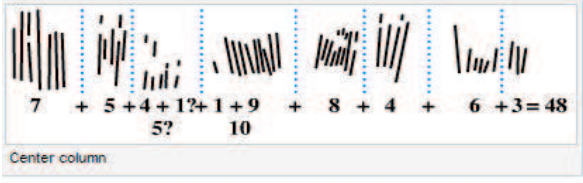
Neural correlates of consonnace in the human braistem, adding to the evidence produced all along in this paper will once and for all, it is hoped, enlighten ceratin musicologists that heptatonism being the result of mathematical interference in the justness of natural tuning, is artificial and was not, therefore a system which appeared spontaneously in the history of musical theorism.

Before heptatonism could be satisfactorily realised, there were many empirical procedures some of which having survived in Ancient Near Eastern texts and probably elsewhere.

Notes

1 Here, I use the word theorism as describing a state of mind which in antiquity had become educated and was propicious to the construction of theory as a consequence of numeracy and literacy; not to be confused with theoreticism which is the preference for theory over practice or, more broadly, abstract knowledge over concrete action, or a philosophical position which would lead to such a preference.

2 The three columns of asymmetrically grouped notches suggest that the implement might have been used for the construction of a numeral system. The central column begins with three notches, and then doubles to 6 notches. The process is repeated for the number 4, which doubles to 8 notches, and then reversed for the number 10, which is halved to 5 notches. These numbers may not be purely random and instead suggest some understanding of the principle of multiplication and division by two. The bone may therefore have been used as a counting tool for simple mathematical procedures. Furthermore, the numbers on both the left and right column are all odd numbers (9, 11, 13, 17, 19 and 21). The numbers in the left column are all of the prime numbers between 10 and 20 (which form a prime quadruplet), while those in the right column consist of 10 + 1, 10 − 1, 20 + 1 and 20 − 1. The numbers on each side column add up to 60, with the numbers in the central column adding up to 48. See hand copy below.



See: *A very brief history of pure mathematics*: The Ishango Bone University of Western Australia School of Mathematics; Rudman, Peter Strom (20007); *How Mathematics Happened: The First 50,000 Years*. Prometheus Books. p. 63; de Heinzelin, Jean: 'Ishango', *Scientific American*, 206:6 (June 1962) 105-116; Williams, Scott W.: 'Mathematicians of the African Diaspora' *The Mathematics Department of The State University of New York at Buffalo*; D. Huylebrouck, 'The Bone that Began the Space Odyssey', *The Mathematical Intelligencer* vol 18 no. 4; Gerdes, Paulus (1991): On The History of Mathematics in Africa South of the Sahara; *African Mathematical Union, Commission on the History of Mathematics in Africa*; Marshack, Alexander (1991): *The Roots of Civilization*, Colonial Hill, Mount Kisco, NY; etc.

3 The relationship between language and gender has long been of interest within sociolinguistics and related disciplines. Early 20th century studies in linguistic anthropology looked at differences between women's and men's speech across a range of languages, in many cases identifying distinct female and male language forms. Gender has also been a social variable in quantitative studies of language variation carried out since the 1960s, a frequent finding being that, amongst speakers from similar social class backgrounds, women tend to use more standard or 'prestige' language features and men more vernacular language features. Aspects of interpretation and of the methodology adopted in variationist studies have however been criticised by some language and gender researchers (see discussion in Cameron, 1992; Coates, 1986/2004; Graddol and Swann, 1989).

4 And of certain insects. About 35 species of ants are helotistic, meaning that they select and enslave selected alien ant species to sustain their colony. However, this is the result of a sophisticated behaviour pattern which cannot be equated to taxonomy as the consequence of numeracy/literacy. (See Wilson, O.E., Slavery in Ants http://antbase.org/ants/publications/13347/13347.pdf); Anne Kilmer offers an interesting proposition with regard the possibility of pre-literate taxonomy in 'Memorizing the Names of Things, From Oral to Written: Mesopotamian Musical Instruments' in *Orient-Archäologie* Band 15. Helen Hickmann/Ricardo Eichmann (Hrsg.) *Studien zur Musikarchaologie IV,* 2004:139-41. There, it is regrettable that the balaị is translated as harp regardless of the fact that it is currently impossible to determine what the balaị would have been at different times of its evolution, both philologic and organologic.

5 A determinative, also known as a taxogram or semagram, is an ideogram used to mark semantic categories of words in logographic scripts. They have no direct counterpart in spoken language, though they may derive historically from glyphs for real words, and functionally they resemble classifiers in East Asian and sign languages. In cuneiform texts of Sumerian, Akkadian and Hittite languages, many nouns are preceded or followed by a Sumerian word acting as a determinative; this specifies that the associated word belongs to a particular semantic group. These determinatives were not pronounced. Some 90% of Chinese characters are determinative-phonetic compounds; the phonetic element and the determinative (called a radical) are combined to form a single glyph. (See Edzard, Dietz Otto, 2003. Sumerian Grammar. Handbook of Oriental Studies. 71. Atlanta: *Society of Biblical Literature*. ISBN 1-58983-252-3).

6 Both the meaning and pronunciation of the characters have shifted over the millennia, to the point that the determinatives and phonetic elements are not always reliable guides. Whether a given sign is a mere determinative (not pronounced) or a Sumerogram (a logographic spelling of a word intended to be pronounced) cannot always be determined since their use is not always consistent. For example the determinative 'GI' = reed which initially was used to describe objects made of reed, such as reed pipes, might have been used, under the stylus of a specialised scribe to describe any type of pipes, some made of reed or of other materials such as silver as with time the classification of the instrument would have become more important that the medium of which it was made. Moreover, this practice would have been emphasised by the jargon of specialised scribes who would have, in relation to their speciality, modified the meaning of specific determinatives to suit the description of items belonging to their trade. Thus determinatives are not necessarily reliable taxonomic identifiers if interpreted generally rather than studied in relation to specific scribal jargon. This survives today as when, for instance we refer to the family of brass or woodwind instruments, where some of them may be made of plastic and when referring to the family of strings, violins produced from a synthesiser have no strings. In a Chinese dialect of the Jiahu region (The Jiahu gǔdí (贾湖骨笛) is the oldest known musical instrument from China, dating back to around 6000 B.C. (Gǔdí literally means 'bone flute') where 8000 years old bone pipes were excavated. The word for bone = 'ku', a determinative, and the substantive for flute 'di', stuck together to end up as the one word 'gǔdí'. Woon gives an extensive list of the various translations of 義符 yìfú: semantic element, radical, determinative, signific, signifying part, significant, significant part, semantic part, meaning element, meaning part, sense-indicator, radical-determinative, lexical morpheme symbol, ideographic element, and logographic part. Among these, 'radical' and 'ideographic' have both been strenuously objected to as misleading. (See Woon, Wee Lee, 雲惟利, 1987. Chinese Writing: Its Origin and Evolution. 漢字的起源和演變). Originally published by the University of East Asia, Macau. Available through Joint Publishing, jpchk@jointpublishing.com). See also Boltz, William G. (1994; revised 2003). The Origin and Early Development of the Chinese Writing System. *American Oriental Series*, vol. 78. American Oriental Society, New Haven, Connecticut, USA. ISBN 0-940490-18-8. For more on the gǔdí, see Zhang, JuZhong, Garman Harboolt, Changsui Wang, and ZhaoChen Kong. 'Oldest playable musical instrument found at Jiahu early Neolithic site in China.' *Nature*. 23 September 1999. 4 February 2007. <http://www.nature.com/nature/journal/v401/n6751/pdf/401366a0.pdf>.

7 Lyres: The so-called Gold Lyre, Iraq Museum, Baghdad, (B 8694; U 12353). This lyre has been seriously damaged during the looting of the museum; Silver Lyre, British Museum, London, (BM 121199; U 12354); Boat-shaped Lyre, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, (UPM 30-12-253; U12355); Plaster Lyre, Iraq Museum, Baghdad, (B 8695; U 12351); Lapis-bearded Lyre, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, CBS 17694, CBS 17684; U 10556); copper bull's head with mosaic band and shell plaques from a lyre, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia (UPM 30-12-484,-696; U 12435) silver bull's head and shell plaques from a lyre, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, (CBS 17065; U 10916); lyre from Pu Abi's grave, British Museum, London, (BM 121198; U 10412); copper bull's head and shell plaques from a lyre, British Museum, London, (BM 121533; U 10577). Harps: harp with silver sleeve and mosaic border, British Museum, London, (123675; U 11781); harp from Pu Abi's grave, British Museum, London (BM 121198; U 10412).

8 http://www.greenwych.ca/fl-compl.htm

9 Bones were not the only materials from which pipes and flutes were made. Bone survives much longer than wood but a less acidic soil would have certainly produced models made of reed or of hollow branches of the elder, the *sambuca*, once the pith removed. The Latin *sambuca* has a disputed etymology. Molinari writes that it comes from the Arabic and is the name of an anise-flavoured drink that arrived to the port of Civitavecchia by ships coming from the East. In the OED, the word stems from Latin *sambucus*, the elder tree. Latin *sambūca* is the equation of Greek *sambýkē*. There is an earlier reference as *iambýkē* and in two late lexica we have *zambýkē*, probably renderings a foreign word starting with something sounding like *zh*. However, in the Greek and Latin literature the *zambýkē/sambūca* was a stringed instrument. The instrument is said to have been fitted with short strings and looked like a Roman 'siege engine' (Ath. 633f; Aristid. Quint. p. 85. 10, who comments on its feminine and ignoble sound). (See West, M.L., *Ancient Greek Music*, Clarendon, Oxford 1992: 75-7). However, besides the string instrument, there was also a flute called *sambūca*, derived from the elder *sambucus*, in which the core is of soft pith which once removed gives a good bore propitious to the making of pipes or flutes. (See Manlius Severinus Boethius Anicius: *Fifth Book of Music*, translated by Paul Oscar, Georg Olms Verlag (1985), ISBN 3-487-04629-6.

10 Lawergren, B., Extant Silver Pipes from Ur. 2450 B.C. (2000), *Studien zur Archäologie II, ed. Hickmann, E., Eichmann, R., Deutches Archäologische Institut, Rahden, Leidorf*, pp. 121-132; Galpin, F.W., *The Music of the Sumerians...*, CUP, 1937, pp. 93-4. For a detailled treatise on flute making, see Forster, C.M.L., *Musical Mathematics, on the Art and Science of Acoustic Instruments*. (2000-2011) Chronicle Books, San Francisco.(www.chrysalis-foundation.org/flute_tone_holes.htm).

11 In an archaeomusicological context, polyphony is not a texture consisting of two or more independent melodic voices. It is an ensemble of different instruments, including singing and dancing, in some instances, playing together in the ignorance of any concept of harmony as we understand it today. There would have been occurences where notes of different pitches would have been played simultaneously, but they would not have been perceived as chords. See Marcetteau, M., A Queen's Orchestra at the Court of Mari: A New Perspective on the Archaic Instrumentarium in the Third Millennium B.C., in *ICONEA 2008, Proceedings of the International Conference of Near Eastern Archaeomusicology held at the British Museum, December 4, 5 and 6, 2008*, Dumbrill, R., and Finkel, I., Eds., pp. 67-76.

12 http://www.youtube.com/watch?v=4o4fH8z3jDQ

13 Lawson, G., Music, Intentionality and Tradition, in *Orient-Archäologie, Band 15, Studien zur Musikarchäologie*, Hickmann, Eichmann, Eds. (2004:61-97).

14 For a comprehensive list of instruments in the Ancient Near/Middle East, see Krispijn, T., Musical ensembles in ancient Mesopotamia, *ICONEA, proceedings of the International Conference of Neatr Eastern Archaeomusicology held at the British Museum.* (2008:125-150).

15 11/1-5 nīš *tuḫrim*; 12 7-5 *šēru*; 13/2-6 *išartu;* 14/1-6 *šalšatu*; 15/3-7 *embūbu*; 16/2-7 *rebūtu*; 17/4-1 *nīd qabli;* 18/1-3 *isqu*; 19/5-2 *qablītu*; 20/2-4 *titur qablītu*; 21/6-3 *kitmu*; 22 3-5 titur *išartu;* 23/7-4 *pītu*; 24/4-6 *serdû*.

16 See Chicago Assyrian Dictionary, *sub embūbu*. Note the absence of the 'm', the mimation, of *embūbu*. Mimation refers to the suffixed *-m* (the letter *mim* in many Semitic *abjads*) which occurs in some Semitic languages. This occurs in Akkadian on singular nouns. It was also present in proto-Semitic. Hence *embūbum*, written with a final 'm', the mimation is the Old Babylonian spelling; *embūbu* was the later orthography which by the first millenium, when CBS 10996 was written, had dropped the mimation. 17 or an interval placed on the third and seventh notes of a scale.

17 The text does not mention any instrument. This suggests that in other instances where string names alco appear, that they should be interpreted as elements of theory and not as organological description.

18 Krispijn, Th. Musical Ensembles in Ancient Mesopotamia, *ICONEA 2008, Proceedings of the Conference of Near Eastern Archaeomusicology held at the British Museum.* (2008:125-151). In the early lexical lists most chordophones (including the players and the songs they accompany) are denoted by the sign balaị 'harp' or componds with balaị. The lexical series E.D. Lu A of the Uruk IVa period (± 3200 B.C.) already includes gal balaị '(leading) harp player', and later lexical lists (Fara period ± 2600 B.C.) have balaị̀di 'singer of harp songs', balaị dilmun 'Dilmun harp', balaị mari 'harp/instrument of Mari', burbalaị '(player of a) special type of harp', and tigi (= NAR+BALAĞ literally 'harp of the singer'). The only other chordophone which could be included in the early lexical lists was gal.zà '(leading) lyre player' or 'singer of songs of praise' (?) (E.D. Lu A 108). zà follows gal šùd '(leading) prayer singer' and therefore could possibly be an abbreviation of zà.mí (zamin) 'lyre'. An objection against this suggestion is that zamin does not occur among musical instruments anywhere else in later lexical lists or literary texts of the 3rd millennium. It is only a word, written zà.me, meaning 'to be praised' or 'song of praise'; cf., zà.me = wādium 'someone who praises' (VE 1181). However, the etymology of zamin 'wide side' suggests an object like a musical instrument.

19 The bolong is at the same time a stringed, percussion and idiophonic instrument. A musician plays its strings, beats its membrane while a leaf of metal with rings inserted all round it, affixed to the top of its arm, rattles as a result of the playing of the strings and the beating of the membrane. The bolong is played by several peoples in West Africa, including Maninka, Fulbe, Senufo, Susu, and Kissi. It is a rare instrument. I would like to thank Mr. Sulaiman Camara, from Guinea Conakry, one of the rare players on the bolong, for his contribution (see http://www.youtube.com/watch?v=LtZiWtVrOVQ), and Lucie Durán from the School of Oriental and African Studies: *Dear Richard, well the word bolo in core Mande languages means hand, and bolon (bolong) means arm, can also mean an arm/branch of a river (as in the Gambie bolongo of Kunta Kinteh fame!) However, I have never enquired why the bolon should be called so; because it's like an arm? The other possibility is that it's onomatopoeic for the sound it makes. "Bato" means a bridge that sits in the middle of a round object.*

The kora bato is the bridge of the kora. There is no reason why the bolon should not have survived from the ancient world in West Africa - there are other similar survivals in Africa as you know (the lyre etc).

20 Etymology: 1552 (Pontus de Tyard, Solitaire premier dans ses Discours philosophiques, 14b, éd. 1587 cité par Vaganay ds Rom. Forsch., t. 32, p. 29); 1808 arg. appuyer sur la chanterelle (Hautel). Dér. de chanter*; suff. -erelle, forme allongée de -elle*. Fréq. abs. littér. : 16.

21 In musica il bordone è un effetto monofonico di accompagnamento in cui una nota suonati in modo continuo per buona parte o per l'intera composizione, sostenuti o ripetuti, e spesso determinano la tonalità della composizione stessa. L'uso del bordone ha origine nella musica antica dell'Asia di sudovest e si diffonde poi nell'India dell'est, nel nord e nell'ovest dell'Europa e nel sud dell'Africa. (van der Merwe 1989, p.11). Allo stesso tempo, un bordone è la parte di uno strumento musicale che produce delle note sostenute, generalmente senza una particolare attenzione dell'esecutore. Il sitar ed il sargam indiano sono strumenti ad arco capaci di eseguire dei bordoni.

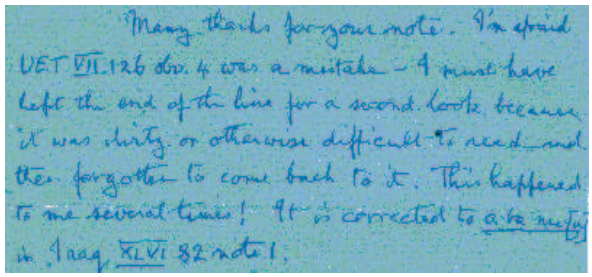
22 Dumbrill, R., *The Archaeomusicology of the Ancient Near East*, Pls. 229; 228; 227; 230; 236; 254; 250; 248; 225; 256; 247; 231; 249; 219.

23 It is possible to make educated estimations of frequency on lutes and other stringed instruments if the nature of the string is known. In the case of gut strings, the animal providing the intestines needs to be know: Sheep, pig, or cow since these are the most common. It is highly probable that for lutes, it was sheep gut that was used because cow's guts would have an appropriate mass, pig's would not have been used because of its mediocre quality. It is known that a string rings best closest to its breaking point therefore 80% of the breaking point would be an acceptable estimation. From this the frequency can be estimated with about 20-30% error, which is reasonbly adequate for an instrument over 4000 years old. My own experiments with Uruk-Akkadian lute replications give a chanterelle at 'A' 220Hz. It is impossible to say how the other, or the two other strings were tuned to each other. (See illustration top right.)

24 Hilprecht, H.V., *Mathematical and Chronological tablets from the Temple Library of Nippur*, Published by the Dept. of Archaeology, University of Pennsylvania (1906); Crickmore, L., The Tonal Systems of Mesopotamia and Ancient Greece: some Similarities and Differences. *ARANE*, Vol. I, (2009:1-16); Dumbrill, R., Four Tables from the Temple Library of Nippur: a Source for Plato's Number in Relation to the Quantification of Babylonian Tone Numbers, *ARANE*, Vol. I, (2009:27-39)

25 i) Inbal Shapira Lots and Lewi Stone, Perception of musical consonance and dissonance: an outcome of neural synchronization, Biomathematics Unit, Faculty of Life Sciences, Tel Aviv University, Ramat Aviv 69978, Israel, in J. R. Soc. Interface (2008) 5, 1429–1434 doi:10.1098/rsif.2008.0143, Published online 11 June 2008. ii) Gavin M. Bidelman and Ananthanarayan Krishnan, Neural Correlates of Consonance, Dissonance, and the Hierarchy of Musical Pitch in the Human Brainstem. Department of Speech Language, Hearing Sciences, Purdue University, West Lafayette, Indiana 47907-2038. in The Journal of Neuroscience, October 21, 2009 • 29(42):13165–13171 • 13165.

26 The tablet appears in Ur Excavations Texts. Publications of the joint expedition of the British Museum and of the University Museum of the University of Pennsylvania, Philadelphia, to Mesopotamia. Volume VII, Middle Babylonian Legal Documents and other Texts. Oliver R. Gurney. Note the lacuna in l.4, col. 2 which was later corrected in *IRAQ* XLVI 82, note 1. Professor Gurney writes back to me on this matter on the 15th April 1996:


"Many thanks for your note. I'm afraid UET VII.126 obv. 4 was a mistake – I must have left the end of the line for a second look because it was dirty or otherwise difficult to read and then forgotten to come back to it. This happened to me several times! It is corrected to a-ta-ne-[ta] in Iraq XLVI 82 note 1.

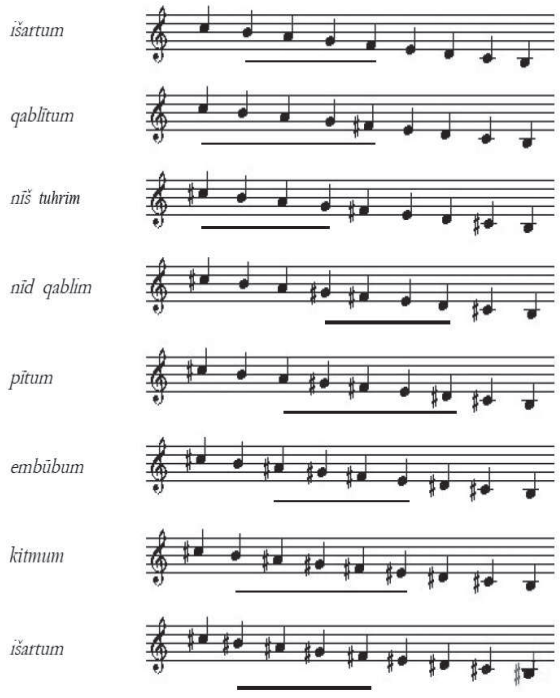
This text has been published at length. For an overview and comprehensive bibliography see Dumbrill, R, AANE 2005:27-36.
UET VII 126 = *nabnitu* XXXII:
l.1 String-first front/fore (string)
l.2 String-second second
l.3 String-three-string-thin third, thin
l.4 String-four-small Ea-creator
l.5 String-five fifth
l.6 String-four of the behind fourth behind
l.7 String-three of the behind third behind
l.8 String-two of the behind second behind
l.9 [String-one] of the behind one behind
l.10 [Nine] string nine string

27 In the *CAD*, the string instrument for which a string nomenclature is listed, is dogmatically tyranslated as 'harp' although a) no instrument either in Sumerian or in Babylonian is mentioned and b) we have no conclusive term to equate to either hap, lyre or lute. This is a misleading translation.

and UET VII 74:

0 *[šum-ma* ^{giš}ZÀ.MÍ *pi-i-tum-ma]*
1 *[e-e]m-b[u-bu-um la za-ku]2 ša-al-š[a-am qa-at-na-am tu-na-sà-aḫ-ma]*
3 *e-em bu-bu-u[m iz-za-ku]*
4 *šum-ma* ^{giš}Z]À.MÍ *e-em-bu-bu-um-ma]*
5 *ki-it-mu-um [la za-ku]*
6 *re-bi úḫ-ri-im [tu-na-sà-aḫ-ma]*
7 *ki-it-mu-um i[z-za-ku]*
8 *šum-ma* ^{giš}ZÀ.MÍ *k[i-it-mu-um-ma]*
9 *i-šar-tum la za-[ka-at]*
10 *ša-mu-ša-am ù-úḫ-ri-a-a[m tu-na-sà-aḫ-ma]*
11 *i-šar-tum iz-za-[ku]*
12 *nu-su-ḫ[u-um]*
13 *šum-ma* ^{giš}ZÀ.MÍ *i-šar-t[um-ma]*
14 *qa-ab-li-ta-am ta-al-pu-[ut]*
15 *ša-mu-ša-am ù-úḫ-ri-a-am te-[ni-e-ma]*
16 $^{[giš]}$ZÀ.MÍ *ki-it-mu-[um]*
17 *[šum]-ma* ^{giš}ZÀ.MÍ *ki-it-m[u-um-ma]*
18 *[i-ša]r-ta-am la za-ku-ta-am t[a-al-pu-ut]*
19 *[re-bi] úḫ-ri-im te-ni-e![-ma]*
20 $^{[giš}$ZÀ.MÍ *e-em-bu-bu-um]*

28 Thetic disposition of scales.



29 Hagel, S., *in Musical traditions in the Middle East: Reminiscences of a distant past : A conference on ancient and modern Near East musicology.* Leiden University, The Netherlands Thursday 10 December 2009 to Saturday 12 December 2009. (Forthcoming)

30 THÉORÈME XVIII. — Les parhypates et les trites ne partagent pas le pycnum en parties égales. En effet, soit B une mèse, G une indicatrice, D une hypate. A partir de B, relâchons d'une quinte en Z, Z-D sera donc un ton. A partir de Z, surtendons d'une quarte en E. L'intervalle BE sera donc un ton, ainsi que G-E. Ajoutons l'intervalle commun D-G;Z-G sera donc égal à D-E; or, Z-E est une quarte; donc aucun son moyen ne peut tomber en proportion dans l'intervalle Z-E, car cet intervalle est superparticulier. De plus le (rapport) D-Z est égal au rapport G-E [lequel est aussi superparticulier] ; donc, aucun (rapport) moyen ne tombera dans l'intervalle D-G, lequel va de l'hypate à l'indicatrice. Donc la parhypate ne partage pas le pycnum en parties égales. Il en est de même de la trite.

31 The sources for Greek music and music theory are as follows:

Classical period:

- Clay epinetron (knee-guard for sewing) with black-figure painting by the Sappho Painter showing a trumpeting Amazon and the syllables TOTĒ TOTOTE apparently representing the notes sounded. Eleusis Museum 907, early 5th century B.C.

- Euripides, *Orestes* 140-207. Scraps of information on the music of this lyric dialogue from two sources: (i) Dionysius of Halicarnassus, *Comp.* 63f., makes a number of statements on the relative pitches of syllables in lines 140-2, which must apply also to the corresponding words in the antistrophe at 153-5. (ii) The scholiast on line 176 says 'this song is sung on the top notes and is very high'. The singers were men playing female roles.

- Euripides, *Orestes* 338-44: fragmentary score in Vienna papyrus G 2315 (Rainer inv. 8029), copied c.200 B.C.

- Euripides, *Iphigeneia in Aulis* 784-92 and 1499(?)-1509: fragmentary scores in Leiden papyrus inv. 510, copied in the 3rd century B.C. (excerpts; 1499(?)-1509 precedes 784-92; only in the latter passage can any of the notes be made out). The play was first produced in 405, a year after the poet's death in Macedon, by his son, Euripides the younger, so it may be that it fell to the latter to compose the music.

Late Classical or Hellenistic period:

- Two very small fragments of vocal notation, apparently from examples in a treatise: PHib. 231, copied in the mid-3rd century B.C.

- Fragment from a tragedy (?): Zenon papyrus 59533, copied in the mid-3rd century B.C.

- Fragments from tragic and satyric drama (?): Vienna papyrus G 29825 a-fs copied *ca.*. 200 B.C. It is uncertain how many different pieces of composition are represented.

- Fragments of poetic text, parts of which arc provided with vocal notation: *POxy.* inv. 89B/29-33, copied 3rd-2nd century B.C.

- Fragment of hexameter hymn to Asclepius with notation for first line only: inscription from precinct of Asclepius at Epidaurus. *SEG* 30390. Inscribed about the late 3rd century A.D., but the composition, like several others from this site inscribed ai the same period, may be many centuries older.

Later Hellenistic Period:

- Athenaeus, Paean: substantial fragments of a choral work performed at Delphi in 127 B.C. by the Athenian Tecknitai, a company of professional musicians, and inscribed on an external wall of the Athenian Treasury at Delphi. Delphi Museum, inv. 517, 526, 494, 499.

- Limenius, Paean and processional: substantial fragments of a work similar to 10, performed on the same occasion and inscribed beside it. Delphi Museum, inv. 489, 1461, 1591, 209, 212, 226, 225.224,215,214.

- Fragments of a vocal text or texts: inscribed blocks from a sanctuary of the Carian deity Sinuri near Mylasa, probably 1st century B.C. The text extends over many lines, but not a single complete word is preserved.

Roman period:

- Song of Seikilos: inscribed stele from Aidin near Tralles (Caria, like 12). Copenhagen, National Museum, inv. 14897, commonly dated to the 1st century A.D.

- Invocation of the Muse, transmitted in MSS with songs of Mesomedes, but differing from them in dialect and (it may be felt) in musical style. The MSS give no indication of authorship; the dialect points to Ionian origin.

- Mesomedes, invocation of Calliope and Apollo: MS transmission. Mesomedes was a noted citharode and composer of Cretan origin, a courtier of Hadrian.

- Mesomedes, hymn to the Sun: MS transmission.

- Mesomedes, hymn to Nemesis: MS transmission (the music only in one MS).

- Three further pieces by Mesomedes, though now transmitted without musical notes, are accompanied by scholia which state the key of the music. In Heitsch's edition they are poems 4 (Lydian), 5 (Hypolydian), and 7 (Lydian). But the accompanying descriptions of the metres do not altogether accord with the metres of the poems; the scholium on 7, at least, seems to have attached itself to the wrong poem, and the same may be true of that on 4.

- Six elementary instrumental exercises, preserved in Anon. Bellerm. 97-104.

- Fragment of a satyric drama (?): *POxy.* 2436, copied in the 1st or 2nd century A.D. The poetic text might be old (though satyr-plays were still written in the 2nd century A.D.), but the music is in the later style.

- Dramatic recitative: Oslo papyrus inv. 1413 fr. a, 11.1-15, and frs. *b-e* copied in the late 1st or 2nd century A.D.

- Speech from a drama about Philoctetes: same papyrus, fr. *a* 15-19 and frs.*f-m.*

- Dramatic dialogue on the return of Orestes: Michigan papyrus inv. 2958,11. 1-18, copied in the 2nd century A.D.

- Fragment of obscure content: same papyrus, 11. 20-7.

- (a-e) Fragments of obscure content: POxy. 3704, copied in the 2nd century A.D. It is not clear whether more than one composition is represented.

- Fragments of uncertain content: *POxy*. inv. 102/5 8(c)↓ and 105731(c), copied in the 2nd century A.D.

- Others: *POxy*. inv. 63 6B 63/K(l-3)(b)→, 72.13(g)→, and 100/122(c), copied in the late 2nd or early 3rd century A.D.

- Fragmentary paean: Berlin papyrus inv. 6870,11.1-12, copied in the later 2nd or early 3rd century A.D. (on the verso of a document dated to 156 A.D.

- Fragmentary instrumental piece: same papyrus, 11.13-15.

- Fragment of a dramatic lament on the death of Ajax: same papyrus, 11.16-19.

- Fragmentary instrumental piece: same papyrus, 11. 20-2.

- Fragment of dramatic(?) lament: same papyrus, 1. 23.

- Dramatic fragments concerning Thetis and Achilles: *POxy*. 3161 recto, copied in the 3rd century A.D.

- Fragments of lament involving Persians and Lydians same papyrus, verso.

- Fragment of uncertain content: *POxy*. 3162, copied in the 3rd century A.D.

- Fragment of a tragic(?) verse with four alternative musical settings: *POxy*. 3705, copied in the 3rd century A.D.

- Fragments of uncertain content: *POxy*. inv. 100/81(b) and 100/125(a)↓, copied in the 3rd century A.D.

- Fragmentary Christian hymn: *POxy*. 1786, copied in the later 3rd century A.D.

32 *pitu* A (*pitu*) s.; 1. break, opening, breach, 2. opening ritual, opening ceremony. pitu C s.; (a musical term); OB, SB, NB. 7,4 SA *pi*(text GAD)-*tum* Studies Landsberger 266f. CBS 10996 i 9 (NB), cf. ibid, i 23, see also Iraq 30 229 right col. before line 1 (OB); *siḫip pi-t[im]* paired node JCS 48 52 ii' 9' (OB), also ibid. r. ii 3'; 5 *ḫansu* GIM *pi-tu* Iraq 46 73:8; [. ..] 2 ki.min (= *šiṭru*) *ša pi-i-te* URI.KI two songs [...], of *p*., Akkadian KAR 158 viii 15 (SB catalog of songs); [. . .] 4 GABA.MEŠ *ša pi-i-te* ibid. 48.

34 Forthcoming.

34

Lines	Akkadian numbers and names	Translation
11	1-5 *nīš tuḫri*	rise of the equiivalent
12	7-5 *šēru*	song
13	2-6 *išartu*	normal, erect
14	1-6 *šalšatu*	third
15	3-7 *embūbu*	reed-pipe
16	2-7 *rebūtu*	fourth
17	4-1 *nīd qabli*	fall of the middle
18	1-3 *isqu*	lot/portion
19	5-2 *qablītu*	middle
20	2-4 *titur qablītu*	bridge of the middle
21	6-3 *kitmu*	closing
22	3-5 *titur išartu*	brirge of the normal
23	7-4 *pītu*	opening
24	4-6 *serdū*	lament

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37

notes	1	2	3	4	5	6	7	8	9	10	11	12	13
1.11	1>				5								
1.12					5<		7						
1.13		2>				6							
1.14						6<		8					
1.15			3>				7						
1.16							7<		9				
1.17				4>				8					
1.18								8<		10			
1.29					5>				9				
1.20									9<		11		
1.21						6>				10			
1.22										18<		12	
1.23							7>				11		
1.24											11<		13

38

1	8.640.000 *A-AN*[5]	25	518.000
2	6.480.000	27	480.000
3	4.320.000	30	432.000
4	3.240.000	32	405.000
5	2.592.000	36	360.000
6	2.160.000	40	324.000
8	1.620.000	45	288.000
9	1.440.000	48	270.000
10	1.296.000	50	259.000
12	1.080.000	54	240.000
15	864.000	60	216.000
16	810.000	64	202.500
18	720.000	72	180.000
20	648.000	[80	162.000]
24	540.000	[81	160.000]

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40 Coburn, J., A New Interpretation of the Nippur Music-instruction Fragments. *JCS* 61 (2009)

41 Waerzeggers, c., and Siebes, R., *N.A.B.U.*, (2007), no.2 (juin), pp. 43-45.

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44 In general, a heptagram is any self-intersecting heptagon (7-sided polygon). There are two regular heptagrams, labeled as {7/2} and {7/3}, with the second number representing the vertex interval step from a regular heptagram, {7/1}. This is the smallest star polygon that can be drawn in two forms, as irreducible fractions. The two heptagrams are sometimes called the heptagram (for {7/2}) and the great heptagram (for {7/3}).

45 In the history of ancient Greece, the Orientalizing period is the cultural and art historical period informed by the art of Anatolia, Syria, Assyria, Phoenicia and Egypt, which started during the later part of the 8th century B.C. It encompasses a new, Orientalizing style, spurred by a period of increased cultural interchange in the Aegean world. The period is characterized by a shift from the prevailing Geometric style to a style with different sensibilities, which were inspired by the East. The intensity of the cultural interchange during this period is sometimes compared to that of the Late Bronze Age.

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THE EPISTEMOLOGICAL FRAMEWORK OF MUSICOLOGY

Bruno de Florence

During his opening delivery at the 2010 ICONEA Conference, Dumbrill pointed out the importance of the epistemological and theoretical frameworks inside which statements about music in antiquity are made. During question time, I pointed out that although the Aristotlian and Cartesian frameworks seemed to be the most commonly used, they are not the only possible ones. Subsequently, Dumbrill asked me to expose my arguments as a complement to his paper. I am most grateful for both his invitation and editorial assistance.

1. Classical Greece postulated that there was a direct relationship between simple frequency ratio integers in simultaneous dyads and the pleasing sensation with which they satisfied the ear: the simpler the ratio, the nicer it sounded. The attractiveness of this notion was such that a fundamental system was built upon it and which eventually led to what is traditionally known as Western Classical or tonal music. Thus it was the hierarchy of simple interval ratios which had guided creativity in antiquity. During the initial stages of harmonic exploration, the Greek theoreticians gave preference, in qualitative terms, firstly to the unison (1/1), followed by the octave (2/1), the just fifth (3/2), the just fourth (4/3). About a thousand years earlier, the Babylonians considered that perfection came principally from the just fifth (3/2), the just minor (5/4) and major (6/5) thirds. The unison (1/1) the octave (2/1) and the fourth (4/3) were denied the status of perfection probably because with an ancient tuning procedure, only just fifths and thirds were consistently stable.

When von Helmholtz set out to give music a scientific basis,[1] he showed that the simplest musical tone ratios did not generate interferential beats and therefore were the most pleasant to hear.

Two independent research studies carried out recently have shed new light on the matter.[2] Both explored the reactions of neurons in the auditory cortex and concluded in questioning Helmholtz's views as well as the wide-spread hypothesis that it was cultural acclimatisation which was the cause of the preference for simple interval ratios.

Before proceeding any further, may we be reminded of neuron physiology and of their role in sound perception phenomenology.

2. When air pressure variations (sound-waves) reach the ear, they are converted into electrical impulses which in turn are transported to the neurons in the auditory cortex.

A neuron is a specialised cell principally located in the brain. It receives and forwards small quantities of electrical current to synapses which are its elongations. Although neurons are densely packed, their synapses are not in direct contact with each other. The electrical current received by a neuron, or of a group of neurons, is forwarded along its synapses, flows through the gaps between them which is filled with chemicals, and reaches the synapses of the nearest neuron, or group of neurons. The whole process of receiving is called the 'charge' and forwarding, the 'discharge'. It takes a certain time which is proportional to the strength and frequency of the electrical current. When a neuron has finished forwarding its 'charge', its neighbour may be or not ready to receive it. For instance, the target neuron may be busy forwarding a 'charge' that it just received. The time taken for 'charge' and 'discharge' is referred to as a 'mode state'. It is modelled on the behaviour of electrical oscillators.

3. The first study,[3] published in 2008, came from the Biomathematics Unit of the Faculty of Life Sciences at Tel Aviv University.

It consisted in a range of experiments carried out between 1996 and 2003. It was observed that

when pure tone[4] intervals consisting of 1, 4, 6, 7 and 9 semitones, neurons exhibited an optimal 'mode state' for intervals made up of 7 semitones. As soon as a neuron 'discharges', its neighbour is ready to receive and forward it as a 'charge'. The interval of the fifth produces the shortest transmission time. This was irrespective of whether it was played simultaneously or consecutively. This is an important observation which conflicts with Helmholtz' conclusions. The authors of this study showed that the neurons have a behavioural preference for simple frequency ratios and more generally, the stability index of the 'mode-locked' states (or degree of neural synchronisation) which reveals a correspondence with the theoretical ordering of musical intervals according to their consonantal evaluation.[5]

The research consisted of a survey of a range of experiments carried between 1996 and 2003. Of interest was the fact that when pure tones[6] with intervals of 1, 4, 6, 7 and 9 semitones were played to human subjects, neurons exhibited an optimal mode state for intervals of 7 semitones, in that as soon as a neuron had finished its discharge, its neighbour was ready to receive and relay it. In other words, the interval of the fifth produced the shortest transmission delay, and therefore the fastest neuron to neuron transmission. This was irrespective as to whether the tones were produced simultaneously or sequentially, an important observation which does not support Helmholtzian conclusions. As the authors of this first study concluded, there is a 'behavioural preference for simple frequency ratios' on the part of the neurons, and more generally, 'the stability index of the mode-locked states (or degree of neural synchronisation) reveals a correspondence with the theoretical ordering of musical intervals according to their consonance evaluation'.

4. The second study,[7] published in 2009, originated from the Department of Speech Language, Hearing Sciences, at Purdue University, in West Lafayette, Indiana.

It consisted in measuring brainstem frequency-following response, that is the amount of neural activity in the human brainstem in response to auditory stimuli. Various intervals of pure tones were presented to ten subjects with no formal musical training. The results showed that 'the unison elicited significantly larger neural pitch salience[8] than all other musical intervals except the octave, its closest relative. The minor second, a highly dissonant interval, produced significantly lower pitch salience than the perfect fourth, perfect fifth, tritone, major sixth, and octave. As expected, the two most dissonant intervals (minor second and major seventh) did not differ in pitch salience. The perfect fifth yielded higher neural pitch salience than the major third and major seventh. The octave…yielded larger neural pitch salience than all of the dissonant intervals (minor second, tritone, major seventh) and two of the consonant intervals (major third and major sixth)'.

5. Both studies clearly appear to corroborate one another.[9] The neurons in the auditory cortex have a strong preference for the way in which specific pitch intervals are handled when converted into electrical impulses. There is an optimal mode state behaviour (see above) for those intervals. This neuronal preference mirrors perfectly the intervals hierarchy aesthetic of Classical Greece. That hierarchy is therefore neither arbitrary nor it is the result of a cultural fancy, but it is the logical expression of a concrete neuro-biological determinant. Neurons are literally 'thirsty' for simple frequency ratio intervals. What early Western musical practice tried to achieve was to produce what it was best capable of hearing. At this stage, it is proposed that the notions of consonance and dissonance denote a process and not a quality or an essence.

The authors of the second study have not taken in consideration an important matter. Although they noted that the unison and the octave produced the highest neural pitch salience, followed by the fifth, it is nevertheless possible to favour the fifth, considering that to the untrained ear, the harmonics of the unison and the octave are similar, while those of the fifth are different. Compared to the first two intervals, the fifth has both high pitch salience and high differentiation. This would constructively explain its fundamental and absolute pivotal role in the development of Western contrapuntal music, and the importance of the I-V-I framework. This role was extensively theorized upon in the 19th century by Adolf Bernhard Marx[10] and Heinrich Schenker,[11] and is still taught today in

university first year music courses. With Western pop music, which also uses the I-V-I framework, chart toppers are consistently songs using the most direct progression through the three harmonic regions of I, V and I. The public spends money on what is easiest to assimilate, as determined by the human neuro-biological substrate.

A further study,[12] published concurrently to this paper shows that intense pleasure in response to music can lead to dopamine release in the striatum.[13] Dopamine is a chemical only found in the brain and is closely associated to pleasure. It is often called the 'feel-good' or 'happy' hormone. The same applies to serotonin.

6. We shall now re-examine the issue of the fifth from an entirely different framework, showing how a fixed and pre-determined biological outcome can nevertheless lead to multiple different sensations of subjectivities. But first, we shall declare the variables of our framework.

No one is the mere product of one's biology. While an individual may carry the gene for blue eyes, a fact over which he has no control, how he relates to the fact of his having blue eyes is another matter. He may enjoy having blue eyes, or dislike it and wish he had green eyes instead. Further, how he relates to the satisfaction or dissatisfaction is another parameter which has to be considered. That is construed as the subjective standpoint, which would seem to imply a mind capable not only of self-reflexion, but also of reflection on its self-reflexion, and so on, in a hyperbole of infinite regress.

Implicit to this outcome though, is the consideration of the mind as a unitary entity, an epistemological assumption inherited from Aristotle, Descartes and Hegel. Their combined philosophical legacies have directed Western epistemology with regards to our thinking capability. This background framework is taken for granted, and is never initially declared. This can sometimes lead to muddled debates. For instance, I once saw on a musicology online forum the following question: How could Beethoven have produced such beauty in his last chamber quartets, when deaf, old, tired and unhappy? In other words, how could unhappiness cause beauty? The hidden assumption underlying this question is Aristotle's notion of efficient cause, or determinism, which leads to the postulation that joyful music can only be the fruit of a happy mind.

Clearly, a different model of the mind and of thinking are needed if one does not want to stray on the path of infinite regress or weird causalities. Let us now turn to Sigmund Freud and Jacques Lacan.[14]

7. Freud[15] postulated a mind made of different parts, each of which entertains a causal relationship with the others. The overall outcome of these interactions is the sensation of an intentional and united consciousness. Freud also differentiates between perception, or the phenomenon as it manifests itself to our senses (for instance sound waves reaching the ear and transformed into an electrical current), its inscription on the psychical apparatus (as a memory-trace),[16] and the effects that perceptions and inscriptions have on the different fragments of the mind, as well as on previously inscribed perceptions. For Freud, mind or the sensation of thinking and of being aware of thinking, are the result, at any one time, of a retroactively dynamic structure and of its content. Most importantly, he considers that consciousness is a quality, not an essence. Therefore a memory-trace can have the quality of being conscious or unconscious, that is present or not present to our awareness. In the latter case, it does continue to exist.

Jacques Lacan was able to show the correspondence between structuralist semiotics and Freud's account of the mind.[17] Freud's memory-traces can be taken as signifiers linked by two sorts of logical relationships, metaphor and metonymy (condensation and displacement for Freud). The overall outcome of these relationships produces an effect of meaning, and the way we relate to that effect produces what Lacan calls a subject, or a subjective position (or Mind in terms of philosophy). Here, 'subject' has to be understood as subject of and to the effects of signifiers, and is therefore a product of the chains of signifiers. This constitutes a radical difference with the notion of subject as conceived by traditional dualist philosophy.

However, Lacan goes beyond strict determinism. He borrows[18] and adapts the two notions of chance causality from Aristotle's Physics:[19] automaton (αιτιολογία), or chance events in the world at large, and tyche (τύχη), or 'chance insofar as it affects

agents capable of moral action'.[20] A chain of signifiers causes a structure of meaning (automaton), which allows for a unique logical expression (tyche). It is common knowledge that a perception will produce different effects (and reactions to the effects) with different people. While the signifier 'table' will produce the thought-sensation of a particular table for each particular person, yet in all intent and purposes, it denotes the same object. This is because the effect of meaning (automaton) produced by the same set of signifiers is an internal process particular to each individual (tyche). Further, a signifier which has been acquired long ago may not immediately create an effect, until it becomes linked to another signifier acquired recently, and reciprocally. We therefore have a constant, circular and repetitive but not complementary interaction between automaton and tyche. While they both combine to produce a subjective standpoint, this nevertheless results in a *vacillating* subject,[21] in that when such a standpoint is reached, it does not become permanent. A dynamic retroactivity is at play, in that past and present affect each other. This standpoint is inscribed in the psychical apparatus and affects previous inscriptions, and this in turn conditions how new perceptions will be inscribed.

Since the mind is made of different elements reacting to each other, the following dialectics between the concrete and the subjective can now be considered:

- A perception is received by the senses.
- It produces a sensation.
- That sensation is inscribed in the mind.
- It may or may not combine with other signifiers or inscriptions.
- This produces an effect of meaning, which itself becomes inscribed.
- Other parts of the mind network and other signifiers react to this effect thus producing further effects of meaning.
- A temporary effect or sensation of subjectivity is established.

This is a continuous movement where each part of the network affects all the others. There is therefore the effect (phenomenon + sensation + meaning), the reaction to the effect, the reaction to the reaction of the effect, and so on.

The 'colour', orientation and intensity of the effects, as well as one's reactions to them are on the side of tyche. Their expression or transposition into logical thoughts is on the side of automaton.

Thinking is the result of a constant autonomous process, in which no synthesis or teleology plays any role. No one is able to step aside from it, notwithstanding the claims of some Eastern philosophies.

The advantages of such an epistemological approach are numerous:

- The avoidance of the insurmountable question of the cause of the cause, which had led Aristotle to postulate an initial unmovable cause, that which moves all others but is not moved, Descartes to postulate God as a guarantor of Mind, and Hegel to formulate a historical teleology of the Spirit. All three philosophers needed an externality to account for the internality of the mind. Instead, we are dealing with an independent multi-part structure constantly reacting with itself.
- It refocuses the epistemological debate on where a sensation arises, that is in the mind, and not what causes it.
- It differentiates between perception, sensation of perception and effect of sensation of perception, and of its logical expression as meaning.
- It accounts for the unique character of each subjective standpoint, since the flavour or orientation of such a position is on the side of tyche.
- It accounts for the temporal variability of subjective standpoints.
- Those subjective standpoints are not quantifiable, computable, or predictable. Teleology, or Aristotle's final cause, is no longer an issue.
- It avoids the trap of infinite regress.

Having established our framework and its variables, we can now explore the consequences it affords on our views of the fifth.[22]

8. The two studies aforementioned have shown that intervals of the unison, the octave and the fifth, when translated into electrical currents,

are more readily transmitted from neuron to neuron in the auditory cortex. Among those three intervals, we can consider the fifth as being the most distinct. This is on the side of automaton, with the proviso that the brain has no organic defects. Classical Greece related to that interval in a preferential manner, finding confirmation a-posteriori in the property of the numbers expressing the ratio of that interval. However, numbers are also signifiers, and denote the phenomenon of the perception of quantity. "Simplicity of the frequency ratio" and "consonant" therefore both denote the same phenomenon, and are not the cause of one another. As a net overall result of all the effects involved in the perception of the fifth, a highly favored aesthetic subjectivity was formulated. That subjectivity did not reflect the phenomenon itself, but the effect of its perception on the mind. Combined with the admiration afforded to Classical Greece by Medieval Europe, this itself an effect of the rediscovery of its philosophy, resulted in a new subjective position, whereby the fifth, as ratio and harmonic region, became the absolute orientating principle for early Western music praxis.

The flavour of that effect is on the side of tyche, since we know that there are cultures as well as individuals who express no preferential interest for the interval of the fifth. Indeed, Arnold Schoenberg proposed a composition framework whereby all notes of the scale and all intervals had equal value, on both the horizontal and vertical axis of polyphonic music, adding his own flavour of tyche to what was widely considered a natural occurence.

9. As a conclusion, we hope to have shown the importance of explicitly declaring the variables of one's epistemological framework, irrespective of its origins. This is not so much about trying to resolve the question of how or why we think, but more about exploring the issue of where we speak from. Levi-Strauss had shown that human relationships are inscribed within a symbolic structure and that it is our place in the structure which determines our rapports with our fellow human beings.[23] Irrespective of what a particular noumen may or may not be, it is the myth which gives it its logical consistence, which in turn allows for a subjective orientation. In other words, the word makes the thing.

Equally, I hope to have shown the importance of collaboration between researchers from different disciplines, and of being able to maintain a dialogue which does not lead to a false synthesis or syncretism. In this instance, from archeo-musicology to neurobiology to Lacanian semiotics to musicology and back and forth, each part of the network having an effect of knowledge on the others.

Notes

1 Hermann von Helmholtz, On the Sensations of Tone as a Physiological Basis for the Theory of Music, 1954, Dover Publications Inc., London.

2 We advise the reader that in both studies, the authors seem to have a different understanding of the notion of interval than that of musicologists. When outlining their results, we have chosen to keep their use of this notion.

3 Inbal Shapira Lots and Lewi Stone, "Perception of musical consonance and dissonance: an outcome of neural synchronization", Journal of the Royal Society, Interface (2008) 5, 1429–1434 doi:10.1098/rsif.2008.0143.

4 A pure tone consists of the fundamental only, with no harmonics present. It is generated electronically.

5 Although the authors do not give the exact value of the intervals they used, they briefly discuss the difference between just intonation and equal temperament tunings.

6 A pure tone consists of the fundamental only, with no harmonics present. It is generated electronically.

7 Gavin M. Bidelman and Ananthanarayan Krishnan, "Neural Correlates of Consonance, Dissonance, and the Hierarchy of Musical Pitch in the Human Brainstem", The Journal of Neuroscience, October 21, 2009 • 29(42):13165–13171 • 13165.

8 Amount of neural activity at a given pitch period and its multiples.

9 They also appear to be in agreement with other studies using Magnetic Resonance Imaging (MRI) to measure brains activity. Some of them are available on the site of the Proceedings of National Academy of Sciences of the United States of Americas. See on www.pnas.org.

10 For Marx's notion of sonata form, see The New Grove Dictionary of Music and Musicians, Oxford, Oxford University Press, Oxford, 2001

11 For schenkerian analysis, see Nicholas Cook, A Guide to Musical Analysis, Oxford University Press, Oxford, 1994.

12 Alorie N Salimpoor, Mitchel Benovoy, Kevin Larcher, Alain Dagher & Robert J Zatorre, "Anatomically distinct dopamine release during anticipation and experience of peak emotion to music", Nature Neuroscience (2011) doi:10.1038/nn.2726. See on www.nature.com.

13 A sub cortical part of the forebrain, involved in cognitive processes.

14 I will only mention those aspects of both Freud and Lacan directly relevant to the subject of this article.

15 Sigmund Freud, The Interpretation of Dreams, tr. A.A. Brill, 1900, Wordsworth, London.

16 Sigmund Freud, Letter to Fliess 52, in The Standard Edition of the Complete Works of Sigmund Freud, Vol. 1, tr. A. Strachey, Vintage, London, 2001.

17 For an introduction to Lacan's teaching, see Anika Lemaire, Jacques Lacan, tr. David Macey, Routledge & Kegan, London, 1996.

18 Lacan Jacques, Le Séminaire, Tome 11, Les quatres concepts fondamentaux de la psychanalyse, Seuil, Paris, 1990.

19 In the days of Aristotle, Physics meant Nature.

20 Dylan Evans, An introductory dictionary of Lacanian psychoanalysis, Routledge, London, 1996.

21 Lacan Jacques, Le Séminaire, Tome 11, Op. Cit.

22 Further detailed elaborations of this approach can be found in Bruno de Florence, Musique, sémiotique et pulsion, L'Harmattan, Paris, 2008.

23 Claude Levi-Strauss, The Elementary Structures of Kinship, Beacon Press, London, 1977. See also Markos Zafiropoulos, Lacan and Levi-Strauss or Freud's Return 1951-1957, Karnac, London, 2010.

DANCE IN IRON AGE ISRAEL/PALESTINE 1200 - 600 B.C. Archaeological sources and Glyptic Art

Batyah Schachter

Dance, in relation to archaeology, introduces a contradiction. Dance is time-based art; it vanishes as soon as it ends; it leaves no traces, unlike music, which while being also time-based, leaves instruments as tangible relics. Dance leaves nothing. All information collectable about dance is entirely secondary, under the form of visual documentation and textual references. With dance in the ancient world, we are dealing with second-hand information. It is an activity for which we lack knowledge about its performance. The venues and circumstances during which people danced; what dances looked like in ancient times – all is unknown to us.

Dance is documented in ancient Near Eastern texts among which the Bible.[1] In visual representation, which is the focus of the present article, dancers are recognizable – sometimes clearly and explicitly and sometimes more ambiguously or debatably. Identification of dance based on inanimate representation alone, in the absence of direct information regarding the mode of its performance needs reliance on criteria qualifying the activity represented as a dance.

Firstly, we must determine what dance is so that we may focus perspicaciously on our appreciation of the figures depicted on artifacts or otherwise. Since the documentation available is in the form of impressions of artists with various disciplines, we must also examine their artistic guiding principles, their intentions in creating the objects as well as the visual tools they used.

The first part this article firstly discusses the difficulties in identifying dance in static form on the iconography and secondly discusses the criteria defining dance in ancient Near Eastern art.

The second part is a survey of the iconography of dance in Israel/Palestine during the Iron Age, 1200-600 B.C.E. Some of the examples provided in the present paper have been previously classified by scholars as being representations of dance.[2] Other examples have also been classified as dance on the basis of their similarity with recognised instances.

In cases where it was difficult to define dance, the difficulties will be examined. For the purpose of comparative analysis, Late Bronze Age examples (1400-1300 B.C.E.) stressing the role of artistic style in identifying dance will be discussed.

Defining Dance

Dance is an activity of movements performed by a body in space. We may speak of dance of tree branches in the wind, of birds in midair, of animals in motion, but when we speak of dance in human society, we mean movements[3] performed by the human body. About the definition of dance, we face a dauntingly complex task, since the object we are trying to define is composed of elements that serve human beings in all aspects of life: their movements. However, we must distinguish between various types of movements and attempt at categorizing them in order to determine which are dance and which are not.[4] The need to make such a distinction leads us to analyze different areas of our lives from the perspective of movement. In its broadest definition, dance can be seen effectively in every human movement: the dance of one's hands accompanying speech, the movement of the body as it walks and so forth.[5] Since I wish to deal with dance as it is known and expressed in human society, a definition identifying and distinguishes it from other sequences of movements must be defined.

Notwithstanding the complexity of the issue discussed in the present paper, the concept of dance is generally spontaneously understood by all in a society and requires no explanation or definition for a basic agreement of the type of activity it is. Whether we are talking about dance on a theatrical stage, popular dance in the streets, couples dancing on a ballroom floor, or dancing in the framework of some religious ceremony, the activity will be easily recognized by the observer as being a dance.

Proceeding from an understanding of these two aspects of it, the familiar and recognizable on the one hand, and the more difficult to define on the other, I will attempt at raising some relevant points regarding the definition of dance, and shed light on a few aspects of the current debate on this topic in the discourse of contemporary dance. My aim here is to outline some methodological remarks regarding the depiction and the understanding of dance in the ancient Near East by drawing upon discussions on modern dance theory.

Dance is Movement for Its Own Sake

One basic definition of dance describes it as movement intentionally performed for its own sake rather than an attempt at achieving some other ends by means of it[6]. This definition excludes the whole range of movements of daily life where we use our bodies to fulfill a number of needs or functions where movements are made for a perpose independant to the movement itself. This includes everything from simple daily actions such as speaking, eating and walking, to more complex actions demanding greater attention and clearer intentionality such as playing musical instruments, designing objects, writing, etc.[7] None of these activities can be said to involve dance. The movements made, in this case, are always a means of achieving another end, and the significance of the movement lies precisely in the fact that it satisfies and fulfills the desired result. A clear example can be found in a warrior on a Neo-Assyrian seal from the 8th century B.C.E. (fig. 1)

Here the figure on the left is seen in a dynamic and complex posture, which, in isolation from the context of the bull's tail held in one hand and the spear wielded in the other, could be construed as

Figure 1. Modern impression of a cylinder seal, Neo-Assyrian period, 800-700 B.C.E. (Steymans, 446, fig. 18b)

a dancing figure in motion. In this case, however, the aim of the dynamic pose is undeniably clear: it represents a warrior rather than a dancer.

Accordingly, dance may be defined as an action in which the performance of the movement itself is the center of attention, as opposed to any functional result that may be achieved by means of it. We can sum up by saying that in dance, movement serves to create itself, and that dance is enacted as a series of movements of the human body in a given time and space. [8]

What Is Dance and What Is It Not?

While we define dance as an action in which movement is both means and end, we do not reject the possibility of using non-dance movements in the context and performance of dance itself: 'It is at least possible… that every movement that occurs in dance, may also exist in another context: there is no pattern of movement that can in itself be defined as dance'.[9] Thus, for instance, walking, *per se* is not dance, but dance can certainly include walking as one of the movements it may require. In this case, walking does not serve the aim of moving from one location to another in order to perform a specific action; instead, it is part of the dance. Therefore there is a clear emphasis on the precise choice of the manner of execution of the walking, a concern that would not arise when walking consists in reaching a point.[10]

With contemporary dance, this question is

fully raised because the many inferred intentions with regard the types of movements that are used and their association with specific styles, have been shattered by dancers having created a form of dance that does not rely on traditional dance training.[11] This sheds light on the question of what dance is in the broadest sense, without relying only on a simple and conventional identification of a dancing figure.[12]

Thus we go back to the question as to what precisely defines an action as being dance. In his *Understanding Dance* Graham McFee claims that there is actually no need or ability to make such a definition beyond locating the differences between dance and other similar activities such as gymnastics.[14] He also argues that the only thing that defines this difference is the viewer's mode of observation, and the criteria by which a happening is measured.[15] Thus, for instance, in a gymnastics competition, viewers will note the height of jumps, the speed of progression, and the precision of the gymnast's landing. In dance performance, on the other hand, they will judge the event according to artistic standards: the dancer's expressiveness, the consordance between the dance and the music (if music is required), the harmony or disharmony of the dance and so forth. Here there is a different kind of observation with a different intention, and this intention is what defines one as dance and the other as gymnastics, in the views of both the performer and the observer.[16]

Dance as One of the Performing Arts is a Time-Based Art

Dance exudes through the movement of a body in space and time, and only in the moment of its performance. It then dissolves into oblivion at the end of the performance. There is no possibility of capturing dance in order to look at it again; not even once. Even if we were to sit in the same room and ask a dancer to repeat the same choreography (the same steps to the same beat), we would never see the same thing.[17] The dancer might be a bit more tired, excited, relaxed, well-rehearsed, bored, etc. Thus the same dance can never be repeated. This is even clearer if another dancer is asked to do the same steps to the same beat. Because we have different bodies, internal rhythms and different ideas of interpretation, each person will perform the same dance differently. Even if we could, as viewers, identify similarities, what we would have is not a reiteration of the same choreography. A different dance would emerge each time it was performed.[18]

Nowadays dance can be filmed and played back over again, resulting in the misperception that dance is observable on screen. The performance may be documented, but it has numerous limitations. The camera that assumes the place of the eye provides only a partial image of the whole space and the movement within. Often, the filmed document will reflect the cameraman's proclivities and his own understanding of space, the movement taking place and the hierarchy of importance of the details. Thus, the recorded dance is seen through the restricted and restricting eye of the camera, through calculations, intentions and abilities of another person. The experience of watching dance on screen is very different from that of a live performance, and usually only give a faint image of the dance itself and the experience of it.[19]

Identification of Dance in Ancient Near Eastern Art

Given the problematics in documenting dance even today, the difficulty is even greater with two or three dimensional inanimate objects depicted by artists of other disciplines. The definition of dance in ancient Near Eastern art was approched by scholars only taking a few criteria in consideration to define the art.[20] One criterium for the identification of dancers in Mesopotamian art was put forward by the late Edith Porada[21]. She suggested that a dance posture is evident when the dancer represented is standing or leaping on one foot, while his other leg is lifted and bent at the knee. Two examples of this pose are seen in the upper register of an ancient Babylonian seal (fig. 2), where a pair of figures arranged symmetrically and facing each other, holding hands, with their legs positioned as described above. Porada also provides an example of this posture in Egyptian art. In a wall painting depicting Muu dancers (fig. 3),[22] the same symmetrical spatial arrangement as in the aforementioned seal, with the physical postures of the dancers being very similar.[23]

Fig. 2. Modern impression of a cylinder seal. Old Babylonian period, 1900-1700 B.C.E. (Collon, 153, fig. 679)

This posture, in which one leg is placed on the ground and the other bent, clearly reflects the principles specified by Porada.

Another posture supposed to be representing dancing shows a simultaneous bending of the legs with feet on the ground. These postures are mentioned in Dominique Collon's[24] observations of dance in Mesopotamia. The figures are often depicting as a dwarves with bent legs,[25] sometimes holding a musical instrument. This depiction appears on the lower register the Old Babylonian seal in figure 2. Here, a figure has his legs partially spread, and both knees bent.[26] Another example is of a group of figures with bent knees (fig. 4) holding string instruments (lutes) depicted on another Old Babylonian terracotta plaque. It has its Egyptian counterpart in four ivory figures (fig. 5) described as dancing pygmies.[27] In this rare three-dimensional representation, the four figures appear with their knees bent and spread outward with feet joined. Their arms are also bent and at varying angles.

Bent limbs as identification of dancers has been suggested by Yosef Garfinkel in his book about dance in prehistory.[29] In an analysis of body posture, Garfinkel argues that both in realistic and geometric representations, dancers have bent limbs – arms, legs or combinations of both. It is his proposition that this feature suggests a non-static posture – a dynamic state, a body in motion.[30] Garfinkel designed a table showing the range of limb positions, schematically and geometrically represented in Prehistoric art (fig. 7). The table also gives combinations of the upper (A) and lower (a) limbs as they appear in extant representations.

Another feature defining dance, according to Garfinkel, is the manner in which figures are placed on an object or in an illustration. He argues that most objects bearing a depiction of dance are round (bowls, vases, jugs or cylinder seals), a choice that is not incidental but rather representative of the similarity between activity and reality. According to Garfinkel, the figures are usually arranged in a single line close to the edge of a round object, and sometime close to the center of the object inscribed in a circle[31] (fig. 6). In order to represent a line dance, figures are sometimes drawn along a vertical line running down the vessel rather than around it. In other case, in order to emphasize that it is line dancing rather than circle dancing that is represented, the circle is left unclosed.[32] The arrangement of the figures in a group, according to Garfinkel, is a central criterion for defining activity as a dance.

Fig. 5. Ivory figurines, Lisht, Egypt. Middle Kingdom 1950 B.C.E (Barnett, pl. 7a)

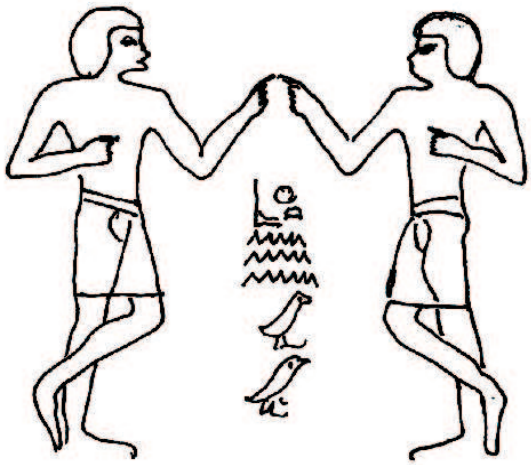

Fig. 3. Detail of wall Painting, Thebes, Egypt. New Kingdom 1500-1400 B.C.E (Author's drawing after Spencer, 117)

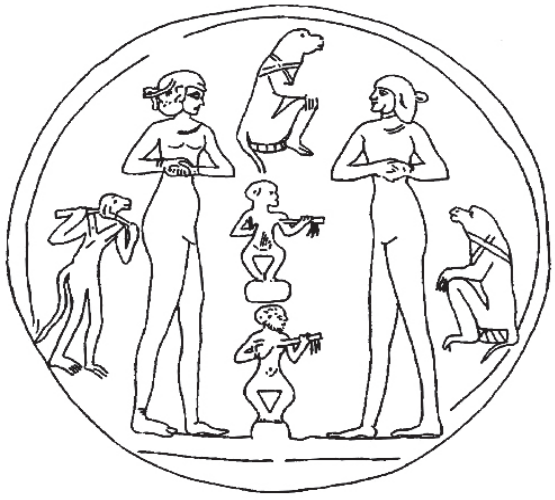

Fig. 4. Terracotta plaque. Old Babylonian Period, 1900-1700 B.C.E (Winter, fig. 256)

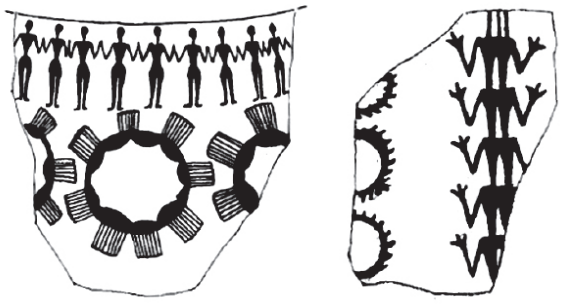

Fig. 6. Pottery shards, Khazineh, west Iran. *ca.* 5500 B.C.E (Garfinkel, 2003a, 165, fig. 9.5a,b)

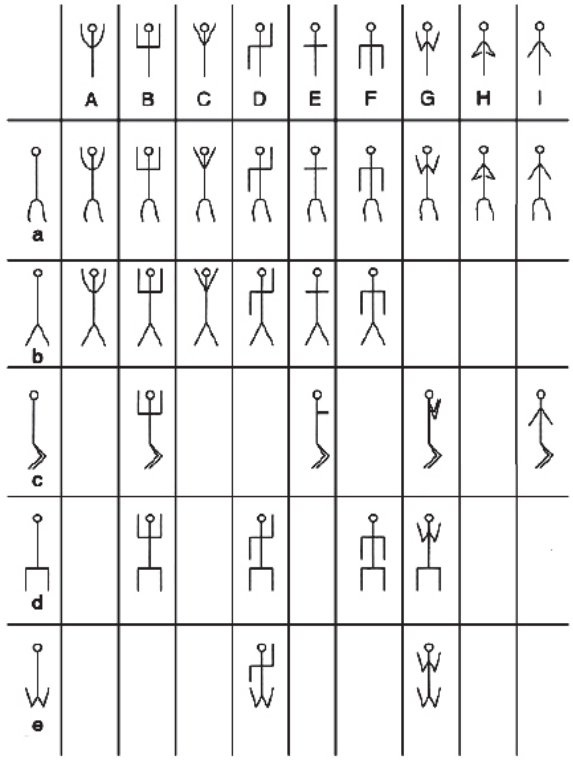

Fig. 7. Basic combinations of legs and arms positions in dance scenes. (Garfinkel, 2003, 32, fig. 2.3)

Dancing Figures in Israel/Palestine in the Late Bronze Age

The earliest example from this period is of a female dancer in a scene that is typically Egyptian. It is an ivory tablet which would have been inlaid. It was discovered at Tell el Far'ah (South), and dates from the late Bronze Age (fig. 8).[33] The tablet depicts a banquet scene where a man, probably a ruler, sits on a folding chair, carrying a bowl in one hand and a lotus flower with the other. Facing him is a standing woman with a lotus flower in her left hand while pouring some drink with her right hand from a vessel into the bowl carried by the sitting man. Behind the sitting man (to the left) is a standing figure, and behind the woman facing him is a nude female dancer accompanied by a feminine figure playing a double-pipe. The upper section of the plaque is broken with the upper part of the dancer's body missing.

What remains of the plaque shows a figure stepping wide, both knees slightly bent and heels lifted off the ground. More precisely, the right front foot touches the ground only with the tip of the toes. Her back is bending forward from the pelvis, and there is a suggestion that her forearm or hand is stretching upward, diagonally in front of her. This figure is exceptional among the other figures on the tablet, both in terms of her being nude and also in terms of the articulation of the details of her movement, showing her body in motion. The position of the dancer's feet echoes almost precisely the long step that is used so extensively to express movement in Egyptian hieroglyphics.[34] Despite the typical Egyptian influence, the object was crafted by a local artist and contains extraneous elements such as the articulation of the faces on the figures and the date palm depicted.[35]

Another example is that of a dancing musician on a clay plaque from Tel Dan (fig. 9).[36] It was found intact *in situ*. The figure wears a mask, plays a musical instrument and is in an asymmetrical leg position. The left leg steps forward, treading on the ground, while the right is bent backwards in the air. The weight of the body is all on one leg and the dynamic step suggests a shifting of weight from one leg to the other, or even a sort of hopping from foot to foot. The figure holds a string instrument (lute) in a position implying that he is playing while moving his body. He wears a mask. We know that dancing while playing the lute was a common scene in the ancient Near East, including Egypt, Mesopotamia, Syria and Canaan (fig. 4).[37] Analysis of the movement in this scene leaves little doubt that figure is playing and dancing at the same time. The sense of movement conveyed in this image is striking. Biran drew our attention to the precise articulation of the right leg, which as he suggests, is extraordinary in its expression of motion which is a testimony not only to the dancer's skill but also to the artist.[38] While such figures and objects are well-known in ancient Babylonia, they are a unique contemporary instance from Israel/Palestine.

The third Late Bronze example is a dancer from Hazor (fig. 10) which appears on a bone plaque which adorned a wooden box, perhaps used for jewels. It was discovered in a building known as a ceremonial palace, on the acropolis of Hazor.[39] The plaque is one of a series in which human figures are shown in a variety of positions: sitting, standing, holding a flower and even one playing a musical instrument. The figure has been identified by Ben-Tor as a dancer,[40] based on its posture and compared to Egyptian instances. Ben-Tor also drew our attention to the similarity with the dancer from Dan (fig. 9), where one leg is bent backward and the other extends forward.

The posture of the figure suggests a significant twisting of the back. Her bent arms are point upwards and form a kind of rhomboidal frame around her head. Her right elbow points in front of her – in the direction of her movement – while her left elbow points backwards. Her upper back, which is turned towards the viewer, has a large curled lock of hair flowing down. Her lower limbs are crossed in relation to the upper ones, with the right leg extended forward and her left leg bent backward. Her head is pointed in the direction of her suggested movement. This posture suggests a movement which is complex and demanding in performance. Given both the complexity of the posture and the dynamism of the representation, the figure is dancing without doubt. The image obviously suggests a transition between a movement and another, almost a leap captured in mid-flow. This is not a position where balance is possible. The sense of motion is also suggested by the slight bending of the foot, leaving no limb in static depiction.

The three Late Bronze artifacts with dancers portray body postures in detail leaving no doubt about the motion created and the complexity of the movements. That these figues are dancing is obvious, even if depicted without any contextual evidence.

Representations of Dance in Glyptic Art in the Iron Age Israel/Plaestine 1200-600 B.C.E.

Iron Age glyptic art in Israel/Palestine includes many depictions which are schematic or geometric, and among them dance. Since this approach allows for little detail regarding human body posture for the purpose of identifying dance, consideration must be taken of artistic principles

Fig. 8. Ivory plaque, Tell el-Far'ah (South), Late Bronze Age c. 1300-1200 B.C.E. (Barnett, 21, fig. 10a)

guiding the representations of the human body, in general, and its movements in particular. Most depictions of dance of that period appear on scarabs and seals. These feature schematic figures walking in long strides, sometimes with one bent arm, and sometimes two. Bent legs are an element that is almost wholly absent from scarabs and seals. Notwithstanding the minimalistic, schematic mode of representation, it is possible, in some examples to feel a willfulness in the dynamic expression of movement. Sometimes this is suggested with arms lifted upwards, typical of dance,[41] and sometimes rendering a step especially wide in relation to the size of the figure. Dancing figures appear mostly in groups: twos, threes or more, in a circle. There are representations of individual figures raising their arms broad-stepping. But on the basis of this alone, it is difficult to determine conclusively whether they are, or not, dancers. Thus only two debatable instances are given.

The survey of types given below is presented according to the spatial arrangement of figures on the objects, as well as the movement characteristics and surrounding elements.

Individual Dancers

Defining individual figures as dancers can be problematic because of the few details hinting at posture and movement. Clues about the spatial arrangement of figures are a critical factor in determining whether the activity represented is dance. The Late Bronze Age examples provided in the previous chapter are identified as individual dancers in respect of detailed articulation of dynamic movements clearly shown. This may support the hypothesis that individual dancers actually existed. I will propose here two examples of figures that may be considered as dancers notwithstanding the inconclusiveness which remains in this respect.

The two examples are carved on scarabs found at Megiddo (fig. 11)[42] and Lachish[43] (fig. 12). On each of the, an single figure is seen with their legs spread suggesting of a long stride, with one arm pointing upward. These examples are rare among seals where dancers can be identified. An elevated arm in such representations is also known to express worship.[44] However, this posture is defined when the arm is bent with the forearm raised, but in this example, the whole arm points upward.

I am of the opinion that these seals represented dance because of the asymmetrical positioning of the arms: One arm is elevated and the other rests down the length of the body (fig. 11), or is not seen in another case (fig. 12). This posture matches Model Db in Garfinkel's table (fig. 7). Neither does the scene suggests any functional explanation for the posture, nor does the seal infer any form of worship. Furthermore, the similarity of the postures to established representations of dance in twos and threes supports the hypothesis that individual dancers could also have been represented in this manner. Nevertheless, the suggestion of movement in these depictions is only hinted. If indeed dance is

Fig. 9. Terra cotta plaque, Dan, Late Bronze period, *ca.* 1400-1200 B.C.E. (Author's drawing after Biran, 2003, 128)

Fig. 10. Bone plaque from a decorated box, Hazor, Late Bronze Age, 1400-1300 B.C.E. (Ben-Tor, 16, fig. 10)

suggested, it is rendered using the posture as a code recognized by contemporaries rather than it is an attempt at a graphic replication of dance or of movement.

Pairs of Dancers

With regard movement, there are two types of dancing pairs. The first is seen on scarabs from Tell el-Farah (South) (Fig. 13)[46] and Lachish (Figs. 14 and 15)[46] where two figures stand next to each other facing the viewer. Each figure rests one arm on the shoulder of his partner while their outer arm is either extended upwards or bent downwards. The example from Tell el- Far'ah (South, Fig. 13) is from a Late Bronze Age tomb, but the style of the seal fully matches extant examples from the Iron Age both in scenes and postures depicted and artistic design. I have therefore included them among the examples presented here.

The second type is seen on seals from Arad (Fig. 16),[47] Tell en-Nasbeh (Fig. 17)[48] and Megiddo (Fig. 18).[49] There, two figures are side-by-side facing the viewer, but here the positioning of their arms is asymmetrical, with one arm upward and the other bent or hanging down. In all instances there is doubling of the figures, which is another feature which agrees with Garfinkel's criteria.[50] The postures in the second type of the pairs are combinations by duplication of the posture represented on Model Db in Garfinkel's table (Fig. 7).

In these representations from Lachish there are various styles of schematic rendering and even one whole geometric figure. All of the representations only show minimal details and yet on closer examination a real sense of movement is felt. The appearance of the dyad and their positioning on each seal is different because it establishes direction, a link between the two figures and even a sense of rhythm emerging from the duplication of the positions and directions. In figures 17 and 18, each head is turned towards the arm raised. In figure 14, it is evident that the way in which the pair's feet point to the same direction may indicate the mutual direction of their movement in space. Compared to the depictions of individual dancers, the movement of dyads are more clearly expressed in spite of the pictorial minimalism of the seals.

Fig. 11: Megiddo. (Keel, Uehlinger, 271, fig. 271a, b)

Fig.12: Lachish. (Keel, Uehlinger, 271, fig. 271a, b)

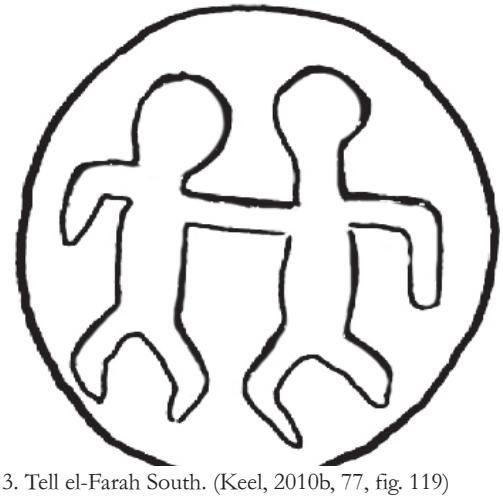

Fig.13. Tell el-Farah South. (Keel, 2010b, 77, fig. 119)

Fig. 14. Lachish. (Author's drawing after Tufnell 1953, pl. 44, fig 68, 69)

Fig. 15 Lachish. (Author's drawing after Tufnell 1953, pl. 44, fig 68, 69)

Fig. 16 Arad. (Keel, 1997, 657, fig. 27)

Fig. 17 Tell en-Nasbeh. (Keel, Uehlinger, 217, fig. 272b)

Fig. 18 Megiddo. (Author's drawing after Lamon/Shipton, pl. 153, fig. 233)

Dance in Triads

Garfinkel sees dancers as figures depicted side-by-side or shoulder-to-shoulder, forming circles or lines.[51] Group dance formations in which participants rest their arms on each other's shoulders are highly common in dance traditions in general and are self-evident as far as collective dance is concerned, considering the structure of the human body and the manner in which limbs are used in movement.

Representations depicting a group of three dancers are found on seals and scarabs from the Iron Age. These figures are side-by-side, sometimes touching, sometimes not but always suggesting some form of collective activity. The structure in which they appear is one of symmetrical repetition, and while the figures may not be exact copies, the basic posture repeats itself, and this lends an overall sense of dynamism. Identifying this composition as a dance scene seems correct given the spatial arrangement and the sense of movement expressed through simple and efficient means. In the excavation report from Lachish, Olga Tufnell notes in describing this group of schematic seals that 'Though they are executed in a primitive style…they manage to convey a great effect of carefree movement.'[52] The examples from Lachish are indeed striking in terms of the illusion of movement expressed through the common posture. In figures 21 and 22, a clear feeling of direction and dynamism is created, which gives the sense that the figures continue their movement even beyond the frame of the seal.

In representations of dancing trios one can find the same positions that we observed above in the images of dancing pairs. Arms are lifted in the air without contact between the dancers, in a manner similar to that of Models Ab and Cb in the geometric table (fig.7); such examples appear on the Lachish scarabs (figs. 19, 20, 21).[53] Arm positions are mixed: some arms are lifted, while others extend down the length of the body, as represented in Models Bb, Db and Eb in the table (fig. 7). These combinations are apparent in the items from Lachish (fig. 22)[54] and Tell el-Far'ah (South) (fig. 23)[55] and Gezer (fig. 24).[56]

This arrangement may be interpreted as indicative of a line dance, which would have been impossible to document more fully on such a small object. In such a case, the triad may have been meant to signify a larger group of dancers. Another possibility is that the scene does in fact depict a triadic dance that existed or was customary during this period.

Fig. 19. Lachish. (Authort's drawing after Tufnell, 1953, pl. 44, fig. 71-74)

Fig. 20. Lachish. (Authort's drawing after Tufnell, 1953, pl. 44, fig. 71-74)

Fig. 21. Lachish. (Authort's drawing after Tufnell, 1953, pl. 44, fig. 71-74)

Fig. 22. Lachish. (Authort's drawing after Tufnell, 1953, pl. 44, fig. 71-74)

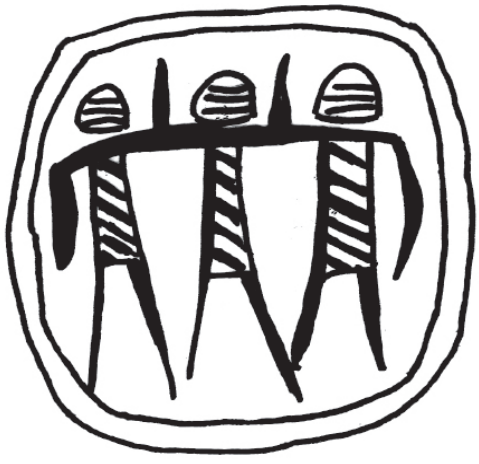

Fig. 23. Tell el-Far'ah (South) (Keel, 2010b, 159, fig. 301)

Fig. 24. Gezer. (Author's drawing after Macalister, pl. 206, fig. 5)

Dancing Around Trees

Human figures represented with trees are a recurrent theme in the southern Levant during the Late Bronze Age and early Iron Age. The tree appears as a sacred element in seals from the region of Judah between the 10th and 8th century B.C.E.[57] There is also a collection of scarabs from the Late Bronze II Age which depict figures raising their arms in the proximity of a tree. These representations could be regarded as evidence of the existence of sacred trees around which rituals were held during the 10th and 9th century B.C.E.[58] Seals with dancing in the vicinity of trees may attest of ritual or cultic practice relevant to dance.

Examination of the articulation of movement and spatial delineation of the figures, shows that the action represented may be dance. The figures not only stand next to a tree, they are also seen with their arms extended upwards and arranged symmetrically vis-à-vis the tree and each other. A dance scene may thus be depicted here. Representations of figures dancing around a tree, a known motif in art of the Iron Age in Israel/Palestine, are found exclusively on seals. Usually, a pair of figures appears flanking the tree, but there are also a few examples featuring an individual human figure, such as a scarab from Tell el-Farah South (Fig. 25).[60] In Cyprus, there is a three dimensional terracotta statuette of three figures dancing in a circle around a tree, a motif known in Cyprus from as early as the second millennium B.C.E. (Fig.32).[61]

Regarding representation of movement, a stride is depicted in all of the examples, with the exception of the model from Judea. (Fig. 26)[62] There, each dancer has one leg bent. The arms are in various positions. They may be stretched sideways, on a seal from Bethel (Fig. 28),[63] raised upwards in an example from Megiddo (Fig. 29),[64] extended in the direction of the tree and the other away from it in a seal from Tell en-Nasbeh (Fig. 27),[65] both extended toward the tree (Fig. 26), and raised at shoulder level in different directions (not entirely clear) in a scarab from Beit Shemesh (Fig. 30)[66] and a scarab from Lachish (Fig. 31).[67]

A phoenician silver bowl has in its centre an unmistakable representation of dance. (Fig. 32) On this object, two highly articulated feminine figures[68] dressed in skirts are seen in a position indicating a complex and detailed movement. Their knees are bent, with one arm raised above the head and the other crossing over the chest. They face each other in symmetry and dance on mounds of earth with a vegetal feature, to the right, suggesting that it is a tree. They hold some fabric and are surrounded by doves which are associated with representations of women and the goddess Ishtar. The posture of the pair manifestly conveys dynamic movement; the twisting of the body suggests a stylized, elaborate and coordinated motion. The existence this detailed scene supports the interpretation of scenes so minimalistically pictorialized in seals as dances around or in the proximity of trees.

Fig. 25: Tell el-Far'ah (South) (Keel, 2010b, 173, fig. 333)

Fig. 26 non provenance (perhaps Judahite) (Keel, Uehlinger, 235; 233b)

Fig. 27 Tell en-Nasbeh. (Schroer, 1978b, 512, fig. 4)

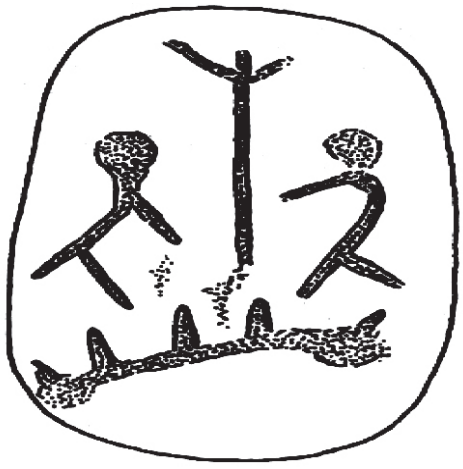

Fig. 30 Beit Shemesh. (Keel, 2010a, 279, fig. 142)

Fig. 28 Beit-el. (Keel, 2010a, 29, fig. 18)

Fig. 31 Lachish. (Author's drawing after Tufnell, 1953, pl. 44, fig. 70)

Fig. 29 Megiddo. (Keel Uehlinger, 151, fig. 179c)

Circles and Lines

Juxtaposed figures one next to the other or one in front of the other, in similar or identical postures forming a single scene. In such an arrangement have been identified both in dyads and triads as representing dance. When more than three figures appear in a scene, the scene may be regarded as the depiction of an organized group dance. Circles and lines are very common and conventional spatial organizations of group dancing. In a chapter dealing with this spatial arrangement, Garfinkel notes the various characteristics of line or circle dancing.[69] One of the features is that in circle dancing there

is a collective focus on a central hub at the heart of the circle, while in line dancing there is usually a leader determining the direction of the movement.

Our illustrations show figures in circle and line formations. A question arises from the observation of a round object ornated with a single line of dancers in a circle. Does it represents the pattern of the dance, or is the pattern dictated by the form of the object? There is an example on a Phoenician bronze bowl in which a line of female dancers is shown along the perimeter of the bowl, yet they do not close the circle. Therefore, this can be read as depicting a line dance. (Fig. 34)[70] Undisputed circle formations are seen in a three-dimensional representation from Cyprus where the figures hold hands and dance together. (Figs. 33)

Lines of dancers appear on a few Late Bronze Age cylinder seals from Israel/Palestine such as from Lachish, (Fig. 35) and are identified by Tufnell as representing a war dance.[71] This cylinder seal is an example in which there is no way of knowing whether the intention of the lapicide was to depict a line or a circle dance, since its duplication could indicate either. It is to be noted that this disposition disappears from the Iron Age Israel/Palestine iconography.

Fig. 32 Central medallion of a Phoenician silver bowl 900-800 B.C.E. ((Author's drawing after Tubb, 123)

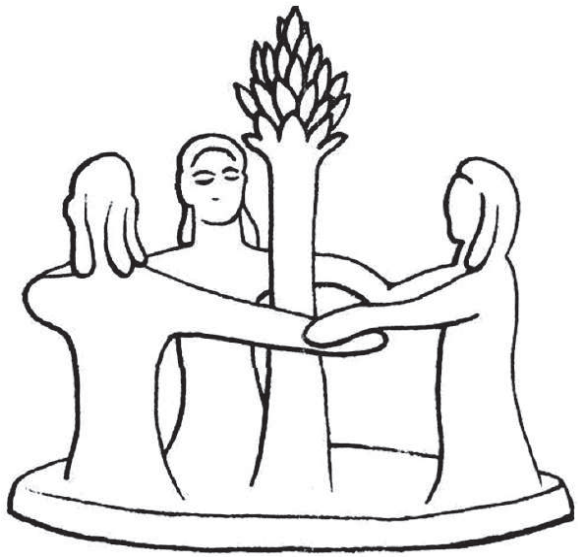

Fig. 33 Terracotta figurine, Cyprus, *ca.* 800-700 B.C.E. (Winter, fig. 471)

Conclusion

The identification of dance in archaeological contexts is complexly challenging. Dance is a phenomenon which cannot be captured in time, and can only be documented through graphic arts. The evidence which is left for interpretation come from a culture having not left any living tradition supporting depictions under the form of stills. We rely on definitions that we formulate in order to distinguish and segregate dancing figures. The identifications that we have discussed in the present paper are based on a definition of dance taken from the contemporary discourse of dance scholars on the one hand, and on the understanding of the artistic codes guiding the ancient lapicides on the other.

Iron Age miniature representations in Israel/Palestine are schematic. In contrast to the Late Bronze Age artifacts showing positions and postures are highly detailled and clearly infer a powerful sense of movement. Iron Age glyptic art exhibits only minimal but suggestive hints of motion. This entails relying on spatial arrangement of the figures on a given object and the examination of few basic body positions for dance identification. The images on Iron Age glyptic finds do not give any information about the type of dance or the type of movement, but represent, describe and highlights the

Fig. 34 Bronze bowl, Phoenician, 900-800 B.C.E. (Author's drawing after Tubb, 122)

practice of dance in society. That dancing scenes were used for seal adornement with amuletic functions[72] which mediated between individuals and supernatural powers, is meaningful. Significantly, these small objects were frequently worn as charms, and often bore the owner's name.[73]

The religious/magical role of dance is also evident in the performances around trees.

Iron Age representations of dance in ancient Israel/Palestine are divided into types according to the kind of movement and the spatial arrangement of figures. There are dancing pairs, triads, lines and circles and show the prevalence of dance as a collective activity, where in small groups. By contrast, there are only a few known depictions of dance showing single figures. This may imply that solo dancing was not prevalent during this period or, alternatively, may suggest that the minimalistic artistic style of these representations made it difficult to convey a solo dance due to the limited means of expressive dynamism. The artists may have preferred the depiction of group dancing as an easier to conveythe nature of the activity. In spite of the schematic character of the representations and the small scale of the objects, a strong sense of movement and the joyfulness of dancing are often successfully conveyed. The examination of these Iron Age glyptic scenes uncovers the footprints of ancient dancers, frozen in their motion, still concealing their secrets.

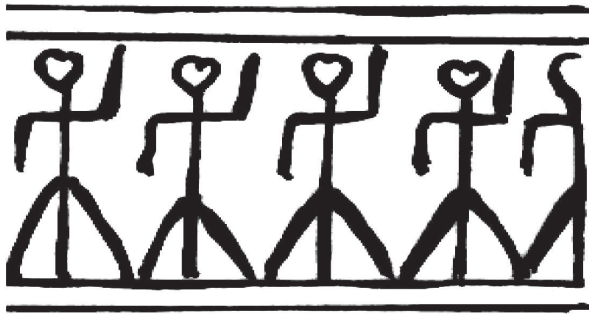

Fig. 35 Cylinder seal, Lachish, 1550-1250 B.C.E. (Author's drawing after Tufnell, 1958, pl. 43, fig. 165)

Notes

1 Gabbay, 2003, 103-104. Gruber 1981, 328-346.
2 Garfinkel 2003, Porada 1969 , Collon 2003.
3 McFee, 1995, 52, 55-6.
4 Ibid. 49.
5 Alter, 1996, 4.
6 McFee, 1995, 51.
7 Ibid., 55-6.
8 Alter, 1996, 7-8.
9 McFee, 1995, 51.
10 McFee, 1995, 49, 51.
11 Ibid. 67.
12 Ibid. 49-54.
13 Ibid. 1995.
14 Ibid. 49.
15 Ibid. 50, 66.
16 Ibid. 58-9, 65-6.
17 Ibid. 1995, 93-4.
18 Ibid. 93-4, 101.
19 Alter, 1996, 14; McFee, 1995, 88.
20 Garfinkel 2002, Porada 1969 , Collon 2003.
21 Porada 1969, 378.
22 Ibid.
23 The main difference between the postures lies in the fact that both of the Muu dancers' feet touch the ground while the figures on the seal stand on one leg with the other leg in the air. Likewise, the Muu dancers' have one foot crossed over the other, while this is not the case with the dancers on the seal.
24 Collon 2003, 92-102.
25 Collon 2003, 99.
26 This figure is termed by Porada (1969, 378) "bow-legged dwarf." Upon closer examination of the posture, one will notice that the size of the figure is no smaller than that of the other figures. The level of his head, which is lower than that of the others, actually results from the bending of his legs. Therefore, his posture indicates movement, rather than a physical condition, and he can properly be regarded as a dancer.
27 Barnett 1982, Plate A7.
28 Three-dimensional representations of dance are rare in ancient Near Eastern art.
29 Garfinkel 2003a.
30 Ibid., 19.
31 Garfinkel 2003, 42.
32 Ibid., 43.
33 Ziffer 2005, 152.
34 Hieroglyph No. D54, D55, Gardiner 1950, 544.
35 Petrie 1930, 19; Tubb 2003, 124.
36 Biran 2003, 128.
37 Biran 2003, 128.
38 Biran 1986, 170.
39 Ben-Tor 2009, 5.
40 Ibid., 2009, 23.
41 Fig. 6 in the present article, Model C in the table.
42 (Fig. 11) Megiddo, bone scarab, Iron Age IIB, Lamon & Shipton, 1939, Pl. 67.19.
43 (Fig. 12) Lachish, bone scarab, Iron Age IIB, Tufnell 1953, Pl. 43A/44.63.
44 Keel & Uehlinger 1998, 152.
45(fig. 13) Tel al-Far'ah (South) limestone scarab (GY), late bronze age, Petrie 1930, Plate 147: XII; Keel 2010b, fig. 119.
46 (Fig. 14) Lachish, limestone sarab, dated to 8th c. BCE, Tufnell 1953, Plate 44.68.
47 (Fig. 15) Lachish, steatite scarab, Tufnell 1953, Plate 44.69.
48 (Fig. 16) Arad, ivory stamp seal, Iron Age IIA, Keel 1997, nr. 27.
49 (Fig. 18) Megiddo, pink stone scarab, 1000-800 BCE.; Lamon & Shipton, 1939, Plate 153.233.
50 Garfinkel 2003, 23.
51 Garfinkel 2003, 31.
52 Tufnell 1953, 363.
53 (Fig. 19) Lachish, paste scarab, Tufnell 1953, Plate 44.72. (Fig. 20) Lachish, limestone, Tufnell 1953, Plate 44.73. (Fig. 21) Lachish, bone scarab, Tufnell 1953, Plate 44.71.
54 (Fig. 22) Lachish, limestone scarab, Tufnell 1953, Plate 44.74.
55 (Fig. 23) Tell el-Far'ah (South), scarab, Petrie 1930, Plate 408; XXXV. Keel 2010b, fig. 301.
56 (Fig. 24) Gezer, ivory scaraboid, Macalister 1912 vol. I, Plate 206.5.
57 Keel & Uehlinger 1998, 152.
58 Ibid., 152, 234. In their book, Keel & Uehlinger suggest the significance of the tree as a representation of Asherah.
59 Ibid. 45.
60 (Fig. 25) Tell el-Far'ah (South), scarab, Petrie 1930, Plate 469, XL. Keel, 2010b, 173, fig. 333.
61 Dunn-Vaturi 2003, 109. A three-dimensional example of figures dancing around a column are known till the end of the 7th century BCE.
62 (Fig. 26) Seal of unknown provenance, gray Limestone, bears Inscription (Avigad & Sass 1997, 97; 154), attributed to end of 8th century or early 7th century BCE.
63 (Fig. 28) Beit-el, stone scaraboid, Iron Age IIA, Kelso 1968, Plate 119c. Keel, 2010a, fig. 18.
64 (Fig. 29) Megiddo, scarab, white steatite, Rowe 1936, Plate XXV:SO23.
65 (Fig. 27) Tell en-Nasbeh, scarab, unknown material (Pinkish Stone), McCowen 1947, Plate 55; 63.
66 (Fig. 30) Beit Shemesh, scarab, light brown steatite, Rowe 1936, Plate XXVII; S72. Keel, 2010a, fig. 142.
67 (Fig. 31) Lachish, serpentine scarab, Tufnell 1953, Plate 44; 70.
68 Markoe 1985, 217. Or two masculine figures, in the antithetical view of Tubb, 2003, 123.
69 Garfinkel 2002, 41-3.
70 Markoe 1985, 217-8.
71 Mazar 2003, 126.
72 Keel 1995, 7.
73 Ibid.

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RECONSTRUCTING THE VOICE OF KING DAVID'S HARPS

Max Stern

For the composer of the 21st century the 12 tones of the chromatic scale have become obsolete. New sounds from processors extend the contemporary musician's sound palette into the unknown. Frequently micro-tones and strange tonalities from various ethnic traditions, once considered exotic, are integrated into contemporary compositions. In sharp contrast the instruments in King David's iconography, such as harps and lyres are relatively humble and have few strings. The question raised here is are such instruments capable of making music of any aesthetic value.

While the precise materials, sounds, and playing techniques of ancient instruments are unknown, an extensive heritage from earlier times is to be found among native people today;[1] the techniques for stringing and playing the lyre, for example, still survives among Bedouin and Ethiopian folk musicians. These include tying the string to a strip of leather and winding the strip on the yoke; winding the string around wooden pins around the yoke; or tying the strings around pegs, similarly to the mechanisms used in modern instruments.

Ethnomusicological Sources

The Ethiopian baganna is played mainly by aristocrats in a tradition which may date back to the Old Testament. Holy books in Ge'ez record David playing a lyre in the Temple. In the Ethiopian Psalter of Belen Sagad dated from the early 15th century, he is depicted playing that instrument.[2]

Filmed excerpts of Ethiopian musicians accompanying singers were viewed and analyzed in ascertaining the various playing and strumming techniques on the lyre,[3] sophisticated techniques calling for plucking the lyre strings with a number of different fingers of the same hand. These films reveal an almost hypnotic repetition of simple rhythmic figures present the lyre accompaniments as a feature of archaic music in general. In addition there is also good reason to assume a level of musical accomplishment comparable to ancient technical achievements in other arts and crafts.

Although independent compositions for harps, undoubtedly, did exist in the ancient world, for the most part, harps, in such contexts, generally played a supportive role to the voice. Ancient performers were also highly skilled. They were professionals, and thus it is most likely that the skill they attained surpassed contemporary achievements, recorded on documentary films of illiterate folk musicians playing on primitive pipes, string instruments, or drums.

With form and structure, the free alteration of two similar, yet contrasting musical phrases constitutes a principle of literary and musical construction that seems to have existed since earliest times. The structural feature of parallelism so integral to the Psalms finds its roots, undoubtedly in prehistory, but it is found today in the 'call and response' forms of African ethnic music, as well as in Oriental Jewish Psalmody such as in the communities of Yemen, Iraq, Persia, Syria, etc.

The limited scope of recitation tones in this music often corresponds to the number of strings with which ancient harps were fitted. Of great interest are women's songs in the Yemen. They have attracted ethnomusicologists in their search for more archaic strata of musical expression. The non-standard tonal inflections of these songs antedate fixed scale systems and intervallic relations,[4] and one finds in them early signs of modality centered on structural tones, neutral thirds, tetrachords, pentachords, and gapped *quasi*-pentatonic scales - living tonal structural features, which appear in the theoretical writings on music of the Ancient Greeks.[5]

Tuning

Possible tunings for the harp or the lyre from Old Babylonian texts, the oldest dating from about 1800 B.C. were considered.[6] However, I have offered other alternatives for smaller lyres of three, four, five or even six strings. It seems to me that part of the originality of the sound an ancient player produced was the result of the tuning he selected for his own pieces or accompaniments. While there would have been academic tuning procedures, it is also conceivable that individual artists were under no such obligation; especially with smaller instruments playing solo and not in polyphony, where tuning had to be the same for all instruments. Soloists would have chosen any tuning that suited their need, and could change this tuning at will (as for example in *scordatura* on the violin), without regard to conventional theoretical models. This assumes that there is room for exceptional soloists such as David, to adopt other that standard tunings.

With regard the compositions which I propose as models, I will suggest the usage of 'free tunings' as a possible alternative to academic procedure especially with instruments having less that seven strings.

Aesthetics and Musical Character

The musical character of the individual movements (which are expressions of joy, prayer, confession, confidence, and praise) are inspired from the headings and contents of the various Psalms in which they appear. Though, it should be noted, that traditional commentators and commentaries on the Psalms[8] often differ in their understanding and interpretations with respect to the meanings of heading and titles: *Ayeleth Hashachar* (the hind of the morning), for instance, could also be the name of a melody, or a Talmudic reference to Esther; or even an expression of David's sufferings.

Such are the diversity of opinions regarding this title. *Shalishim* were probably instruments playedby women singing joyfully (1 Samuel 18:6). The etymology of the word *SLSH* is from *shalosh*, which means three, the number.

But is *Al Hashemitite* a prayer in sickness, or a deep-toned instrument? Using the same reasoning as above, the term is derived from the word *shemone*, the Hebrew equivalent of number eight. Thus, it seems reasonable to assume that the instrument of this name had eight strings. Does *Al Alamoth* signify female voices, high register sounds, or a plea for refuge, help, or strength? All of these interpretations might be combined, since the instrumental equivalent of female voices are high register sounds; and it is possible that these women were calling for aid or some sort in their prayer. *Maskil Le-Lammed* or *Michtam* is likely to be an instruction to play skillfully. It has an underlying pedagogic or intellectual twist. *Al Hashoshanim* (lilies) may be a love song and in this it signifies a lyric musical character. Yet *Al Shiggaion* (derived from √SGH meaning to err, to sin unintentionally, or go astray) could be a dithyrambic song, an intellectual error, or a form that wanders aimlessly. Is *Shir Yedidot* (√YDYD, meaning friend, beloved, or lovely) a prayer for happiness, or a wedding hymn? While *Al Hagittit* is probably a vintage song sung while stamping grapes, since the 'gat' is the specific enclosure where the juice of grapes was extracted by stamping on them. *Al Tashchith* (do not destroy) could be an expression of confidence in danger.[9]

While all the above research offer clues to reconstructing ancient instrumental tunings, performing techniques, their musical character and form – all of these clues must be filtered through imagination, taste and artistic judgment. Often this process involves intuition, a leap of faith which might play a no less significant role in artistic realization. Perhaps the imagination is the only living relic we share with our ancestors from the dawn of civilization.

Applications

The compositional problem in the reconstruction of ancient music resides in the creation of mood, in how to sustain interest and how to extend over time pieces in which the tonal compass, the technical resources, and the possibilities for modulation, are limited.

The examples that follow suggest plausible, though not necessary unique thought processes that guided ancient composer-performers. They propose a number of possible technical and artistic solutions to the problems of melody, timbre, and form.

These compositions were commissioned by

the Bible Lands Museum in Jerusalem for the exhibition 'Sounds of Music – Music in the Holy land and the Ancient World', in the Winter of 2007, as musical archeology in practice and performance and a recording of them was played as background music during the nine months the exhibition ran. Later I collected the pieces into a single volume entitled *Nebhel and Kinnor*. These pieces are original, yet they are not the work of pure fantasy. They were inspired from recordings of Ethiopian, Bedouin, Yemenite instrumental and vocal music, as well as transcriptions of other ancient Jewish-Oriental sources. Musical motifs, phrases, and concepts were selected, reworked, and adapted. Additional concepts are based upon original research at local Beer Sheba and Jerusalem synagogues from between 1976 and 1979. There were also original field recordings from the collections of the National Sound Library of the Hebrew University, Givat Ram Campus.

The selections were written to be played on replicas of biblical instruments constructed by the noted Israeli luthier and sculptor, Moshe Frumin from Haifa who based his models upon archeological finds such as coins, pottery, carvings, figurines, reliefs, drawings and seals and passages from the Bible, Mishneh and Talmud. While playing these instruments, it was found, that in spite of the attractiveness and diversity of these replications, the sound they produced was remarkably similar in tone quality. Additionally, while these pieces suggest purely instrumental music - the ancient idea of playing an instrument and singing, simultaneously along with it, is a practice very much alive in the folk music of the world - whether this be a guitar or banjo in the West, an ud in the Arabic world, or a one-stringed rebaba in the Bedouin tent. This intimate interchange between instrument and voice, though often a metaphor for the prophetic dialogue within the man himself, as he stretches and reaches to worlds beyond, is an almost universal constant.

Musical structure arises from this urge to give shape to inner, inarticulate experience within performer-poet-composer. The physical instrument, because it is outside his body, is an aid in this process of making objective the intrinsic, since it is a technological construction of man's hand, and compels the player to reach out and concretize the amorphous world of pure feeling within. But it is also a source of inspiration, since even one note on such aninstrument is enough to initiate this process, calling forth voices from the recesses of consciousness. It is from this perspective that we propose the following compositions, which seem, perhaps, quite sophisticated when presented in this context.

Analysis and Commentary

1. AL HASHALISH (And it came to pass as they came, when David was returned from the slaughter of the Philistines, that the women came out of all the cities of Israel singing and dancing to meet king Saul with taberet, with joy and with instruments of musick [shalishim] 1Samuel 18:6), for three stringed 'Kinnor David', reconstructed after a Bar Kochba coin, 132-135 CE, tuned on a conjunctive neutral third (d - e - f). It is based on a Yemenite synagogue chant.

Al Hashalish for example is constructed in verse-refrain form. Here, the verse provides the flexible and expanding element, adding or reiterating a few notes here and there at each repetition or presentation, while the refrain provides the fixed or unchanging element. This fixed element is repeated almost verbatim at each presentation. The structure of the refrain is bi-partite, with a semi-cadence in the middle of the phrase falling on E, while the second part closes on the final, D. The main activity and sustained interest of this piece takes place on the tenor note, F, (in the Gregorian terminology) in the verse phrases, which, likewise cadences sometimes on E and D. These two tones serve also in a dual capacity – as passing and embellishing notes.

The limitation of tonal resources, which seems embedded in the structure of ancient instruments, challenges us to ask fundamental questions about the psycho-archaeo-musicological nature of creativity and the constructive imagination. The limitation of three notes in *Al Hashalish*, for example, provides us with a fundamentally minimalist basis for generating form: beginning, middle and end. It contains an initial point of departure (a tonic note D); it contains a note of continuation and continuity (a tenor note F), which, theoretically, if uninterrupted,

could continue indefinitely; and it contains an optional middle note (E), which functions in many ways to give variety to the two note or dyad skeleton of D and F. Thus, the E serves in three capacities: as a passing note, as a decorating or ornamenting note, and as a point of demarcation between the final (D) and the dominant-continuing note (F). Once this auxiliary note (E) is brought into play, it, in turn, influences reciprocally, the fundamental (D) itself, causing it to take on two additional functions: as a lower neighbor, or as a preparatory note to off-set the E, which then, switches function and serves as semi-final cadence tone. The three tones contain a number of compositional tendencies that seem to rotate around each other. It is this ambiguous quality of the nature of the tones which give a possibility to generate formal structures. In this case, the structure is verse-refrain, in itself an out-growth, as we see it, of the indigenous African 'call and response' style, though its specific source is a Yemenite synagogue tune. In place of the line of call and the line of response, we get here as substitutions - a verse and a refrain. If we say the call is only a half-line and the response also a half-line, then the bi-partite structure of each line is in itself a miniature fractal of this call-response pattern, which in Western theory we denote as semi-cadence and full cadence. If we take each line separately then verse-refrain becomes call and response. There is another possibility here, too. What, if we switch the function of the F and the E, turning the passing note (E) into the recitation note, and transforming the previous tenor (F) into a cadence note.

These distinctions become further blurred when we reflect on the permutation possibilities of ornamentation between the three notes or any two out of three. However, it is worth remembering that both the clarity and the blur have their place in the creative experience. Whether by intuition or by calculation, it becomes clear that ancient musicians must have been conscious of the above options, and made use of them to create their music.

The need to fashion an instrument is itself an expression of some inner, intuitive need to press an inner life force out into the external world and give it some kind of social frame. Perhaps this is the reason that all peoples seem to react with friendliness towards musical instruments, because the instrument itself represents in some deep way a conquest over the unknown within. Form is the outcome of this urge to shape the life force in a communicative way, thereby giving it voice, and with that voice a potential to further extend and develop within a social context; whether that context is oneself, a deity, another person, or an approving collective group of individuals. This process must have impressed itself upon Saul when he witnessed David playing before him. As Scripture relates it had a therapeutic effect.

2. AL AYELET HASHACHAR (To the chief musician on Ayelet Hashachar [the doe or hind of the morning]. A Psalm of David. He trusted in the Lord that he would deliver him. Psalm 22:1, 9), a song of the morning for four stringed lyre, after a painting on a pottery jug, Megiddo 1350-1150 BC, tuned on a gapped scale (f-g-a-c'). It is based on a North African Sephardic chant.

Al Ayelet Hashachar is a one line tune, bi-partite in structure, that repeats over and over again with slight variations. The first half of the phrase, or rather, the end of the first part of the phrase, repeats itself three times before reaching the second half of the phrase. The duration of these phrases is unequal and thus creates as an asymmetric impression, which, in a sense, confuses the expectation of the ear, causing the motif to sound more complex than it actually is. Its pitch outline opens: F G A G F A, this is followed by: C A G F G A and it ends on: A F G F. This central body of tonal material is offset and embellished on top with Cs, and on the bottom with Fs. The perfect fifth sounding between these two tones has a ring that lends this piece a bright harmonic sheen, even though the notes are sounded successively and not simultaneously. It shows that harmony is an illusion of the senses and does not depend entirely upon chords sounding together at the same time. The half-cadence of this phrase falls on the mediant A, while its full cadence closes on F. This pattern repeats about four times. It evolves by repeating sub-motives that extend the overall phrase, per mutating in this way, until reaching a conclusion by expanding the final segment of the tune, thus creating a little coda.

3. MASKIL LE-LAMMED (To the chief musician upon shushan eduth [lily of testimony, perhaps a melody]. Michtam of David le-lamed [to teach soldiers]. Give us help against the adversary; for vain is the help of man, Psalm 60:1, 13), a song to instruct for a four stringed lyre, after a Bar Kochba Coin 132-135 CE, tuned in an enharmonic tetrachord (d- e flat- f sharp-g).It is based on a Yemenite women's song.

The enharmonic tetrachord, G F-sharp E-flat D, functions as a pitch cell within a 4-bar, chaconne-like structure that repeats, perpetually, over and over. The interest in this piece is not a melody *per se* but the fluid mutating of simple tetrachord pitch materials and rhythmic structures that form cellular constructions. These cells then replace each other incrementally, exchanging one element for another in a kind of biological or organic process, here, displacing one element for another, but, never repeating a given pattern in the exactly same phrase or in the same way twice. As it goes along certain patterns emerge that impress our memory and these become source material for the conclusion which is formed by an intensified interchange between a numbers of the variants previously sounded.

This example demonstrates that another structure that seems to emerge from the world of preliterate oral history into the ancient world is the idea of musical cell – either as a rhythmic unit or as a pitch conglomerate. In a sense, these are also very modern concepts drawn from the world of atonal Serialism, yet its basis seems rooted in natural processes that go back to the dawn of civilization. What seems to be the bedrock of consciousness here is the perception of the player-listener. We are intrigued by turning an object around and seeing it from many angles, just as a child discovering the world for the first time. The same goes for the pitches: D E^{b} $F^{\#}$ G or $F^{\#}$ D G E^{b} or G $F^{\#}$ D E^{b} and so forth. Once both pitch and rhythm undergo this transformational process simultaneously, combinatorial possibilities can become quite complex. See further discussion on these points, see commentary to example seven *Al Hashiggaion*.

4. AL TASHCHITH (To the chief musician Al Tashchith [do not destroy]. Mictam of David when he fled from Saul, in the cave. Be merciful unto me for my soul trusteth in thee: yea in the shadow of thy wings will I make my refuge, Psalm 57:1-2), an expression of confidence for six string kinnor, after a pottery figurine , Ashdod 8th Century BC, tuned on a pentachord with a lower drone string (D - g - a - b - c - d). It is based on a Yemenite women's song.

Al Tashchith is built up from a 4-bar tune. Its tonality or tonal structure pivots between a plagal quasi-dominant tone, on C, and a final note, on G. The prominent nature of the note, C is further emphasized by upper and lower neighboring tones; for example, the note - B, functions as a lower neighboring tone, while D functions as an upper neighboring tone. The texture is further enriched by a drone string D, which sometimes sounds, along with the G string, making a double-drone on the quartal sonority formed by the open G and D strings. (This quartal quality is also a result of the tuning of the C G and D strings.) Both of these drone strings (i.e. G-D) serve as reference points, which off-set the melody and lend to it a sense of accompaniment; because of the rhythm they inadvertently generate, they create the illusive quality of an added percussion instrument, sounding simultaneously in counterpoint to the main melody, but in the background.

Commentary

The idea of fractals is a phenomena of nature in which the same pattern is repeated a different levels of magnitude. This same perception may be applied to musical form. For example, if a single rock looks like a mountain under a microscope, or a single crystal takes on and the same shape as a whole fern, or a drop of water may fill a teaspoon, or become a river, a lake or the ocean; so a single line of melody may contain within itself the same proportions (in miniature) as an entire composition. If we conceive of form in this way then we have gone a step up from the basic form of call and response, noted previously. Take for instance the basic unit of the strophe, which is a single line. The line may be made up of 4-shorter phrase units. The strophe is a combination of 4 such lines. The intuitive roots of the 4-line strophe or strophic form seems, to me,

to derive from the same preconscious sources that we find exhibited in the world of inanimate nature as fractals. This may explain why this structure seems to satisfy us as an axiom. Let us examine the piece from this point of view.

Al Tashchith is constructed as a line of eight bars. This line may be perceived as a strophe in itself, made up of four phrases of two bars each (2+2+2+2); the form of the line might be described as A, A variation, A, and A variation. This four sectioned strophic pattern repeats four times, generating a structure of 32 bars; thus the architecture of the piece, as a whole, might be described as a single strophe of four 8-bar units, patterned formally as: A, A, A extension, A extension-variation. Once the motivic material is grasped by the mind as a whole unit, then this allows for further repetition or manipulation on a higher level of expansion and variation. Thus we continue to perceive in the various extensions of the line, a sense of cohesion embellishing the original single-line strophic idea, but moving away from strict, mechanical sing-song to a more sophisticated thought progression. The 'archaeology' of musical instruments must have been accompanied by a corresponding archaeology of musical thought. It seems plausible to me that musical forms must have developed in this way. We find this conception echoed, too in the development of folksongs and ballads from children's plays songs and limericks. It is a progression from strict repetition, to flexible and more subtle expressions.

5. AL ALAMOTH (To the chief musician, of the sons of Korah, a song upon Alamoth [female voices, high pitches]. God is our refuge and strength, a very present help in trouble, Psalm 46:1, 5), a lyric meditation for eight string lyre, after an ivory carving, Megiddo 1350-1150 BC, tuned as a mixolydian heptad with a lower third affix (e – g – a – b – c – d – e' – f '). It is freely based upon motifs from a Yemenite women's song.

Al Alamoth is a lyric meditation, improvisatory in character. In this set of ten pieces, it functions as an interlude, since its flowing quality quite contrasts to the more rigid frames of the previous pieces, which were based, also on more restricted numbers of strings, repetitive rhythmic patterns, and mutating-pitches within melodic cells. Here eight strings are employed. The character they are able to evoke is that of thoughtful cogitation. The ninth range of the tonal material (e – f'), stretched over these eight strings, allows for a greater degree of freedom of melodic movement between pitches, than encountered in earlier pieces.

Commentary

The binding element, in this free flowing composition is the opening motif (E - G – A – B – A), which returns, again and again, after each improvisatory digression. Here these digressions take on a character distinct from the initial theme. Sometimes this consists in repeated recitative-like single tones with grace note embellishments. Sometimes it consists in repetitions of two note or three note patterns that generate their own figurations.

The undulating theme, heard at the very beginning and repeated throughout, though, endows this movement with its fundamental rondo-like character and structure; for it is the character of the rondo that creates a tonal magnet and sets the overall tone of thought around which the various contrasts noted above are off set. It is like a structural pole that focuses the attention and permits contrast, without losing itself in diversity. This is something new. I would imagine that in the ancient world the idea of unity is built up, also, from contrasts.

We find this idea echoed in the structure of Psalm 46 from which this heading comes. Verses 1, 7, and 11 repeat almost identical texts. God is our refuge and strength, a very present help in trouble. The Lord of hosts is with us, the God of Jacob is our refuge.) The word Selah, also a kind of choral call to response sums up verses 3, 7, and 11. In between these verses we get such ideas and images as earth and mountains (v.2), waters (v.3), rage (v.6), desolation (v.8), wars and fire (v.9). Thus, this short musical work mirrors the literary form of the text of the psalm. It seems plausible to assume that the music to the psalm followed this form as well.

6. AL HASHOSHANIM (To the chief musician upon Shoshanim. A Psalm of David. I will praise the name of God with a song and magnify him with thanksgiving, Psalm 69:1, 31), a song of the lilies

for a ten stringed Nebhel Asor [symbolic of perfect harmony], after an un-identified ancient statuette, tuned in pentatonic mode (F sharp - A - B - D- e - f sharp - a - b - d' - e'). It is freely based after a Yemenite women's song.

Al Hashoshanim, with ten notes, has the broadest and fullest range of any piece in this set. Its character is lyric and constructed in a song form, patterned in strophes of four lines. It is significant to note that song form is an historic phenomenon and an intuitive model, as old as music itself. It is familiar to use as a product of Medieval Europe, but there is, also, good reason to assume that the ancients made us of this or similar structures in creating their music, as well.

Commentary

Each line consists in two-bar phrases: 2 + 2 + 2 + 2. This song-like pattern is repeated three times, with slight variations made on each of the iterations. It forms the core of the piece. This central structure is, in turn, framed by an introduction and conclusion. The wide choice of ten notes on the ten open strings of the harp allows for the possibility to enrich and amplify basic notes of melody with drones and bass notes, against it; or, to place the melody in the bass and add decorative or ornamental treble notes above it.

The basic pattern of *Al Hashoshanim* is that of strophic song, similar to example four above, Al *Tashchith*. But, there is also notable difference in the treatment of the musical material. In the present model the strophe is repeated six times (48 bars). Here however, we sense the urge to group the individual strophes into pairs or periods. Analyzed this way we come up with a form of three periods. Another innovation is the tonal (but not rhythmic) expansion of strophes five and six (or period three). Here the rhythm is maintained, but the pitch material no longer repeats. New notes and new melodic directions open up a strict song form into a freer more rhapsodic one. The addition of introduction and conclusion to this basically strophic frame complicates the picture. It further adds to the perception that we are entering a more complex world of thought, in which a form of sophisticated musical development has emerged. This new thought may be characterized as a sense of transition, that is, building a bridge between fixed structural units. No longer are square patterns repeated again and again, or repeated in changing increments, with permutation and variation. A different kind of conception is born here, that of moving from one place to another. Perhaps the ancients, too, possessed this sense of growth and development. As civilization developed it was no longer tied to an agrarian cyclical kind of repetition. The idea of leisure and division of labour created the possibility for freedom of thought, and an attitude of reflection. It is in the probing of the individual's unique personality and perception, expressed as creativity, that seems to emerge here.

The rhythmic basis of *Al Hashiggaion* is a rhythmic cell, constructed as follows: 2+3+2+2 or 9/8 meter. The tonality of this piece pivots between the G sharp (which acts as a dominant) and E (which acts as a final, and not the lowest note of the tetrachord). Around this tertian cell, the other notes of the two conjunct tetrachords (C D - F - A B) fill in, add, variety and color, and serve as passing and embellishing notes. There is a kind of automatic quality built into this selection, since the predetermined elements – the fixed intervallic pivot and the fixed rhythmic scheme – create limits that challenge the flexibility of the composer-performer.

Such patterns, in the thousands, however, undoubtedly provided ancient musicians with sufficient structural frame and limitations, with which to exercise and stretch their limited tonal liberty, as well as exhibit imaginative improvisational skills. The basic thought here is that there is a fixed rhythmic element giving the work its order or skeleton; while there is also a free pitch element (asregards the ordering of the pitches) giving the work its 'flesh', so to speak, and providing an element of fantasy and freedom.

Commentary

The above discussion pertaining to example number three, *Maskil Le Lammed*, may be applied to this example as well. What is fundamental

is that the rhythmic or pitch unit employed be small enough or short enough to be grasped as a single impulse. Once this perception takes place two further elements come into play – those of continuity and variety. Continuity keeps things together, but variety maintains interest and adds flavor. In this configuration, the rhythmic cell supplies the element of continuity, while the permutating pitch cell supplies the element of variety. But, this statement is not an absolute. In the above example, the rhythmic unit 2+3+2+2 is the basic framework. But once this pattern has been established or identified, as such, it need not be slavishly followed. Rather, it too can be varied and transformed; the 3 unit moved around within, creates an engaging asymmetry, such as: 2+2+3+2 or 2+2+2+3.

Once this rhythmic shifting, too, takes shape and becomes fixed in the mind of the listener, then it generates further points of departure which can extend or truncate the cell itself, in a process of natural inner growth, such as: 2+2+2+2+3 or 3+2 and so forth.

8. SHIR YEDIDOT (To the chief musician upon Shoshanim [lilies, a wedding song], for the sons of Korah, Maschil. A Song of loves. With gladness and rejoicing shall they be brought. Therefore shall the people praise thee forever, Psalm 45:1, 16,18), a prayer of happiness for five stringed lyre, reconstructed after a relief, Sennacherib's Palace, Nineveh 681-705 BC, tuned on a pentachord (c-d-e-f-g). It is based on a Yemenite synagogue festival song.

Shir Yedidot is based on a pentachord (C D E F G). The frame is a bi-partite four bar melodicfragment that repeats cyclically with continuous transformations.

The interest in this composition are its melodic components, such as contrasting motivic elements in the structure - an upward leap of a fourth (C F), a recitation tone (F), an upward step-like figure, functioning as a semi-cadence (E F G), an embellished descending tetrachord (F E F E D C), lower drone notes (D, C), and a repeat of the previously stated stepwise figure a tone lower (D E F), functioning this time as a final cadence.

Commentary

The overall metric-bar structure of the tune is 2 bars + 2 bars, with a dominant on the G, and a final on F. That each bar has a different motive and shape allows the composer-performer to repeat or expand an idea through improvisation. There is a momentum generated in this piece that allows for expansion, a momentum that almost demands it. For instance, the single beat (F, E) is sometimes repeated a number of times (F-E, F-E, F-E), stretching a motif almost without effort.

Rotating the motivic content and structural frame in this way, proves an effective means of holding the player's and the listeners attention, which, if it did not take place, but, rather, repeated the same line verbatim over and over, might prove a deadly boring exercise. Again, it is the variation and transformation principle at work. This sense of change against a fixed coordinate is a play upon the potential of exact repetition verse free improvisation. The balance between these two extremes constitutes the essence of the form.

In relation to the strophic idea discussed above (see commentaries to *Al Tashchith* and *Al Hashoshanim*), *Shir Yedidoth* suggests a pre-strophic model. It is a two-line tune in transition, on the way to a becoming strophic form, but not quite making it. The pattern and relationship between the lines is fluid. There is no urgency to combine these lines into a strophe or a period. Rather there is alternation. Sometimes one line repeats three times and is off set by a second line. At other times it may repeat once or twice and then be off set by the second line. At still other times the second line might take the lead and repeat in its own right. Here, we have the musical equivalent to decorative zig zag patterns, lines-etched up and down, that we find engraved on ancient pottery. This two-line pattern generates a sturdy, functional kind of form, in between call and response, and strophic song. For this reason it seems to suggest a communal form of creativity. It stands in distinction to individual and expressive pieces, which contain marked elements of contrast such as we find in a piece like *Al Hashoshanim*, which was discussed above.

9. AL HASHEMINITE (To the chief musician on Neginoth upon Sheminith. A Psalm of David. O Lord rebuke me not in thine anger, neither chasten me in thy hot displeasure, Psalm 6:1-2), a prayer on a deep toned eight stringed harp, after a drawing, Megiddo 3000 BC, tuned in two disjunctive tetrachords (c- d - e - f / g - a - b - c').

Apart from the strictures of fixed rhythm and pitch cells, there is an element of free imagination and intuition which constitutes musical expression as fantasy, and which cannot be denied.

The enjoyment of tone, for its own sake, irrespective of structure, is music too. It is the aesthetic point of departure for *Al Hasheminite*.

Commentary

This piece takes the eight tones of an Ionic (diatonic) mode (C to C), but conceives of them as the conjunction of lower pentachord (C D E F G) and an upper tetrachord (G A B C). It consists in a play upon contrasting melodic directions of the tetrachord (upward: G A B C; and downwards: C B A G), and a lower register melodic phrase, twisting around itself (C E F D E). It suggests an informal, relaxed performance setting, and a mood of contemplative meditation. Here, many of the elements, discussed more fully in the above examples, are combined, such as the descending (C B A G or B C B A G) figure, which stretches a few times; or the little tune (C E F D E or C E D E C) on the bottom, which exerts a kind of a magnetic polar pull.

10. AL HAGITTIT (To the chief musician upon the Gittith [from Gath, a winepress]. A Psalm of David. O Lord, how excellent is thy name in all the earth, Psalm 8:1,10), a vintage song for six string lyre, tuned in a pentachord mode with a lower drone string (G - c - d - e - f - g). Based on a Yemenite women's song.

Al Hagitit takes its inspiration from the 'stamping of grapes' image of a wine pressing song. It joins a melodic pattern (D C D E F D C) to a dactyl (long-short-short) rhythm, in the frame of two bars. To the cyclical rhythmic patterns and permutating tonal variations are added a third element – a lower drone on the open string G.

Commentary

In this model we experience tempo as a factor in ancient music. Tempo is neither rhythm nor tone, it is the speed of the pulse and it has the power to generate mood, excitement, and character. Yet, even though tempo is not mentioned, to the best of my knowledge, in ancient documents, except for, perhaps, the negative references to orgiastic or Dionysian music we find in Plato, it surely played a role in all kinds of ancient music. Thus David must have employed various tempi in his music, and a legitimate understanding, takes notice of it, as well as scales and rhetorical rhythm patterns, that we *do find* inscribed on documents. Tempo suggests a living human element; and is a factor to recon with in all of music.

In reconstructing ancient music, we have no compass to guide us in this parameter, only imagination and taste. But there are models which do exist. Most often these are found today in classical Indian, Arabic, and Persian music. Perhaps, the procedures Eastern musicians follow, resembles ways similar to those in which the ancients conceived of music. I am thinking of the dance-like movements that follow upon introductory and more improvisatory *taqsim*, and the way these are linked together into suites. Such pieces repeat over and over, but avoid monotony by building speed, or creating the illusion of speed, through increased textural density and a crescendo of energy. By increasingly interspersing the drone string with the ever more intricate tonal and rhythmic patterning of other elements, such a *Al Hagitit* builds to climax. It seems to grow by getting faster and faster. It is a direction of form shaped like a crescendo, always increasing activity and always moving ever towards climax.

Conclusion

As these ten original compositions, constructed after various traditional ethnic music transcriptions and motifs demonstrate: The limitation of pitches available to the composer-performer is a

restriction of tonal materials, but not necessarily a limitation in creative imagination. The dimensions of tempo, rhythm, tuning, rhythmic patterning and the sequential possibilities of combining even a few sounds successively are virtually endless. Each piece in this set, composed for a certain tuning of strings is but one possibility, drawn from of a very large potential repertoire that might have been created on the same tonal materials.

The fact that there are ten such examples increases the possibilities ten-fold. Furthermore, each example could also have been altered again, by retuning the intervals in the given number strings. Such a procedure would have increased the tonal and compositional possibilities exponentially.

A key element in our compositions (which, we reiterate so as not to mislead the reader, are not in any way actual ancient music *per se*), and their analysis, has been to reconstruct the 'voice of King David's harps.' The titles of these pieces are taken from the headings of Psalms, whose meanings in themselves are highly unclear and subject to widely differing opinions and speculations. To say that there is no evidence as to how they sounded strikes me as insufficient academic posturing, the security of not being proven wrong.

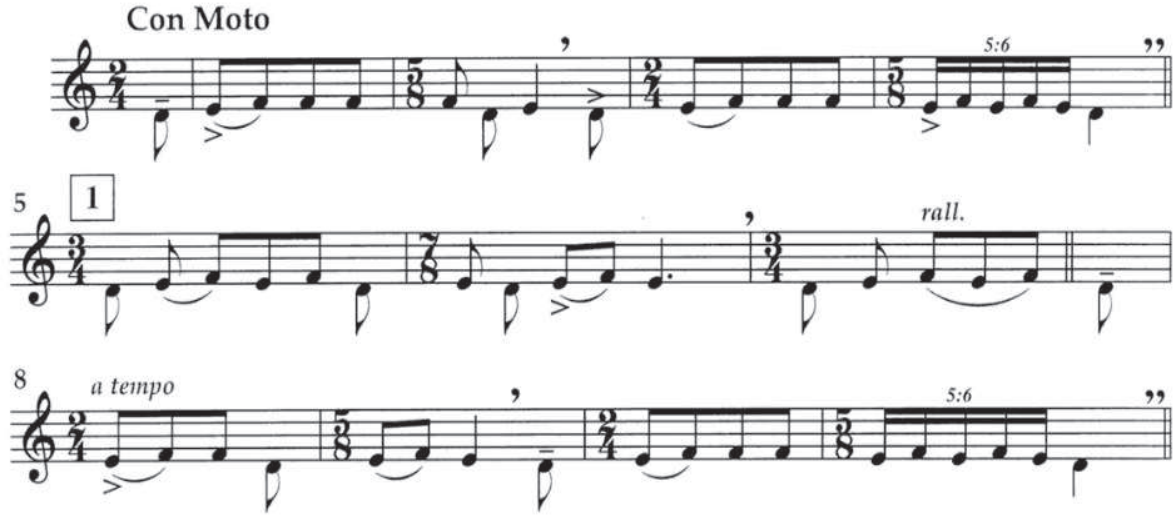
In this, I have tried to take a step into the darkness and illuminate, as far as possible, the kind of music that may have existed behind the titles.

This attempt, however, has caused us to ask basic questions about the creative psychology and mind set of one engaged in making music on these ancient instruments. In the same way that archaeologists make informed guesses based on physical relics of defunct civilizations, we have speculated on the origins of the *patterns of thought* that may have guided ancient anonymous creators to shape their sounds into music. We have further tried to trace these patterns as they developed from simple responses and calls into melodic shapes and units, phrases and lines, strophes and songs. Certain basic ideas such as repetition, variety, momentum, small units building to larger ones, the emergence of recognizable shape, unity, and contrast seem to be universal constants. Literature and word played a part, too.

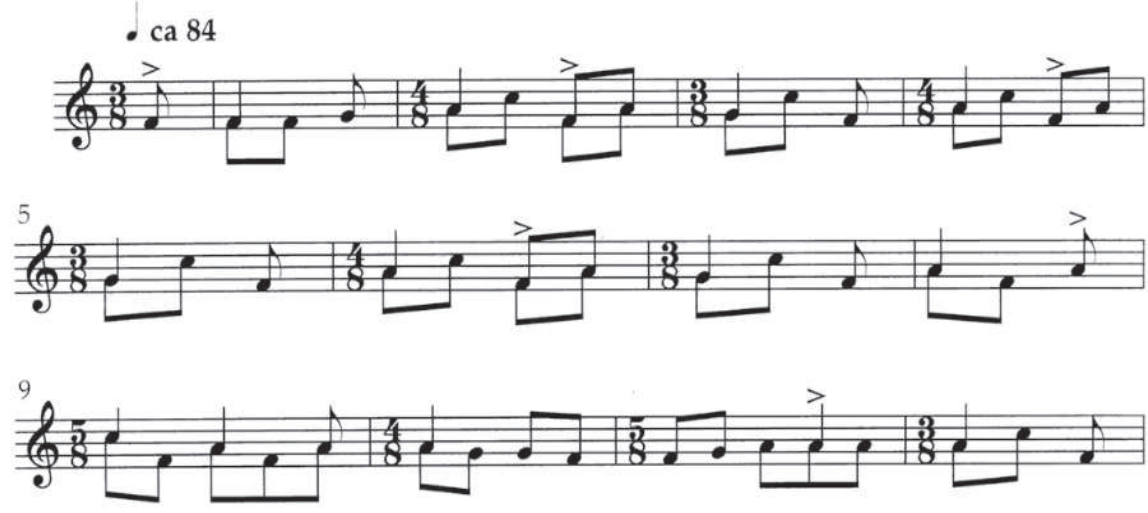
Further questions arise from these investigations: Is folk music an intuitive creation by unlettered albeit inspired individuals and groups of folk; or is it the degenerated memory and popularization of more ancient artistic models, passed down through the ages, but, created by geniuses of a forgotten, bygone era at the dawn of history, who strove to find and fashion a form in which to frame the sounds they made? Perhaps these questions can never be answered, but, surely, they need to be asked.

A number of proto-forms emerge in the above examples. They have been proposed to make a claim on the constructive thought process that may have preceded actual musical notation. Some of these forms include: verse-refrain (example one); various varieties of strophic construction (examples four and six); variation or chaconne-like structures (example three); one line tunes (example two); alternating two-line tunes (example eight), strict rhythmic cellular and pitch cellular construction (examples seven and ten); rondo-like construction (example five); and free improvisation and composition (examples six and nine). The fact that all these procedures appear later, more fully developed, in Renaissance, Baroque, and Classical music does not diminish their possible origins in primordal sources. Rather, it serves to reinforce a kind of universal consciousness (however speculative this idea may appear) that accompanied man on his journey towards civilization. If the sound of ancient harps was thin, we should remember that these instruments were played in a world without electricity, radio, CDs, TV, machinery, drills, airplanes, cars and buses and gadgetry of all kinds. There were no sounds outside of those made by men and animals, hand carts, axes and the like. In such a world, even a slim sound, carefully organized, and directed, meant much. In all, these ten compositions strive to demonstrate the possibilities, variety, and attractiveness, which - the ancient sound of David's harps might have held for those listener-player-composer-poets of his time.

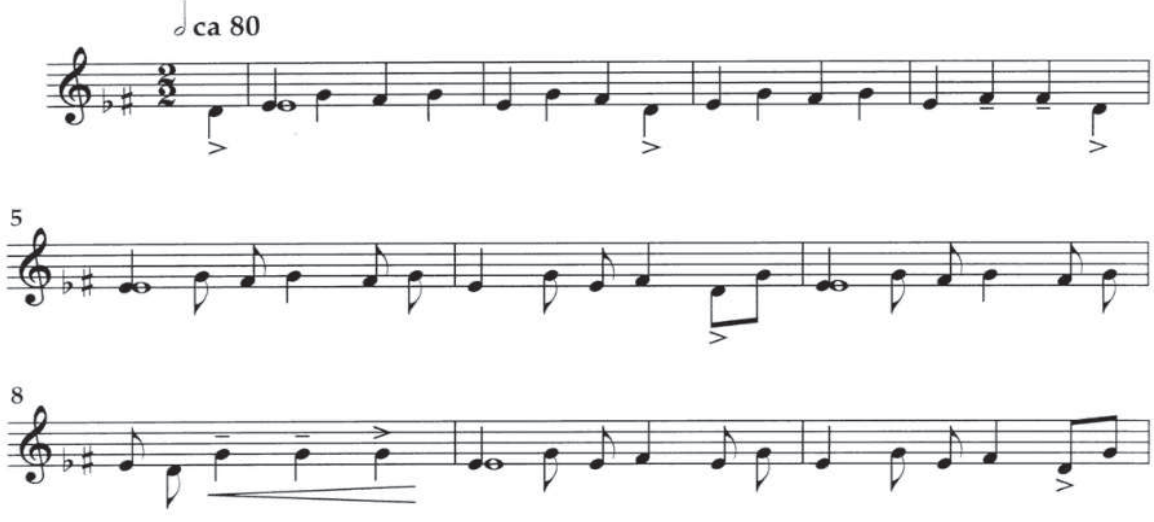
1. AL HASHALISH



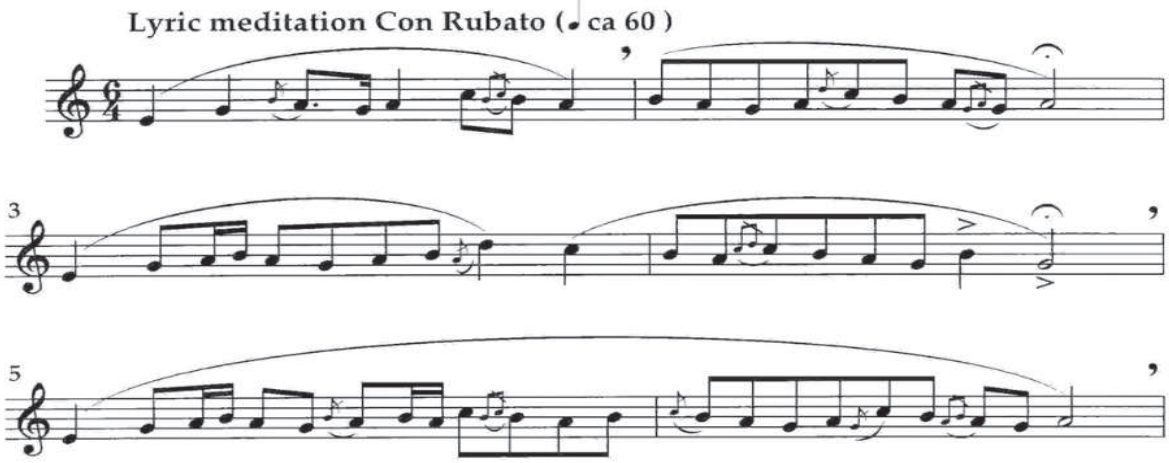
2. AL AYELET HASHACHAR



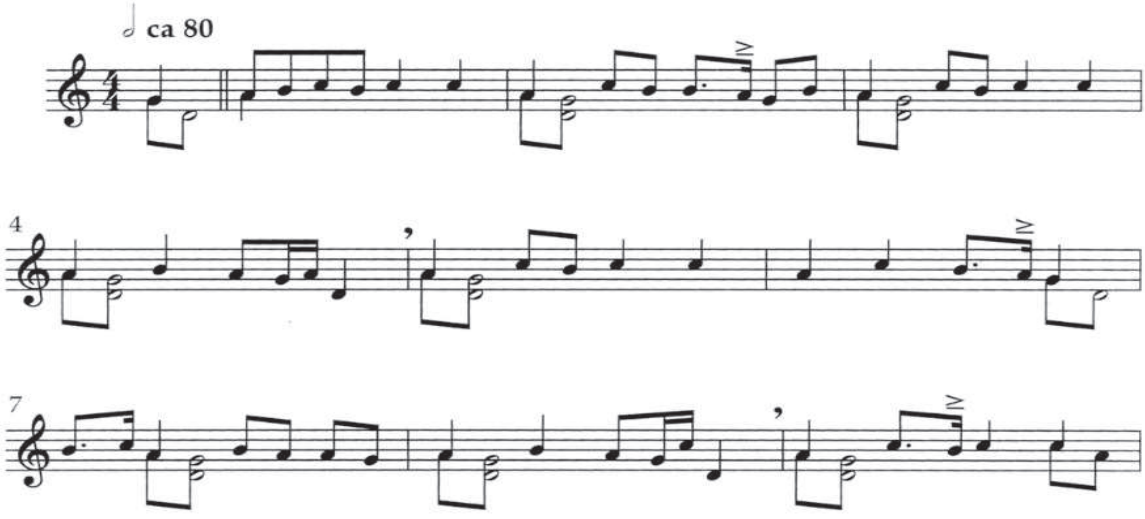
3. MASKIL LE-LAMMED



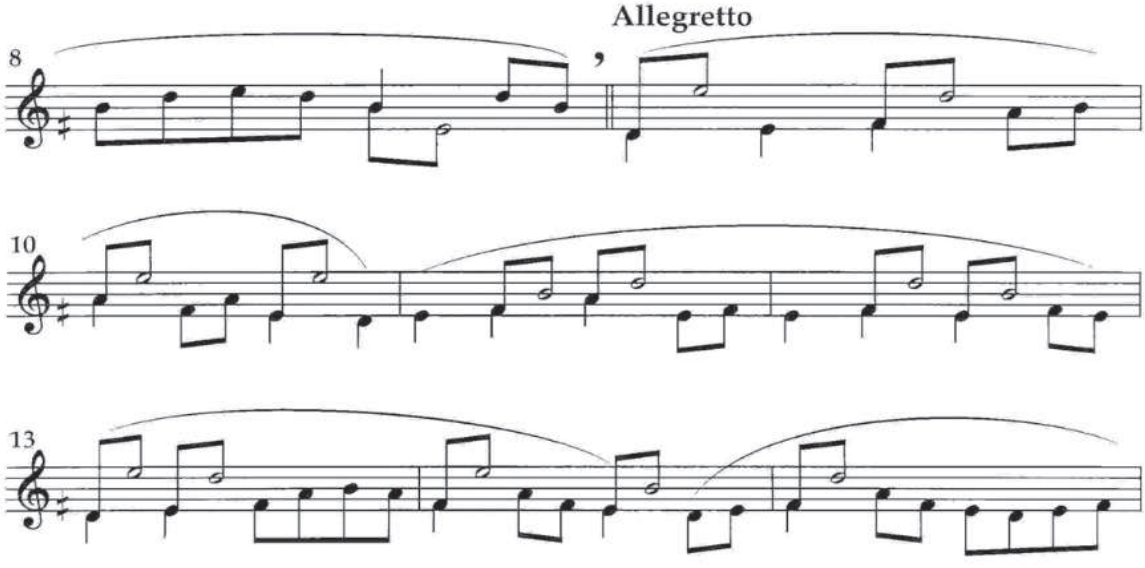
5. AL ALAMOTH



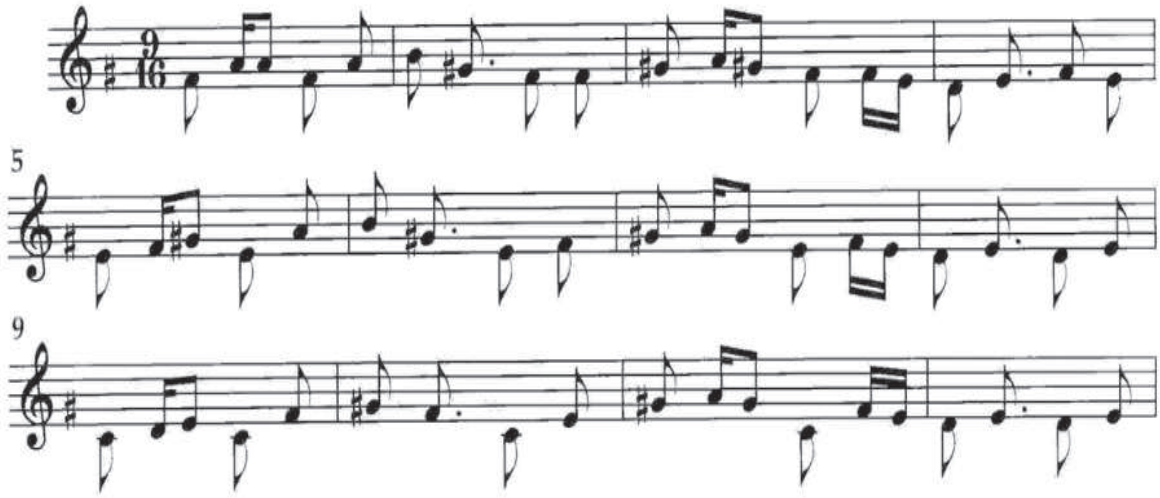
4. AL TASHCHITH



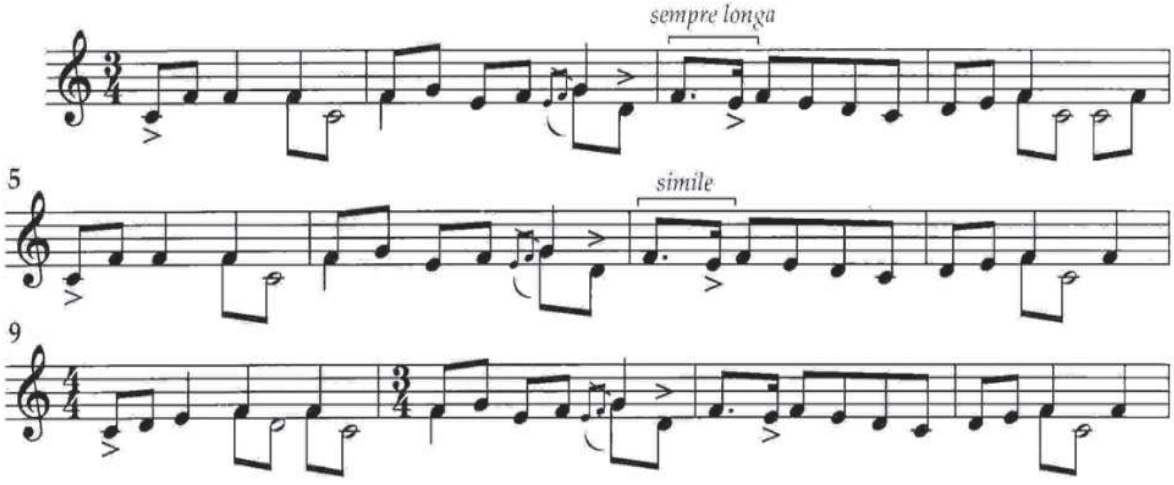
6. AL HASHOSHANIM



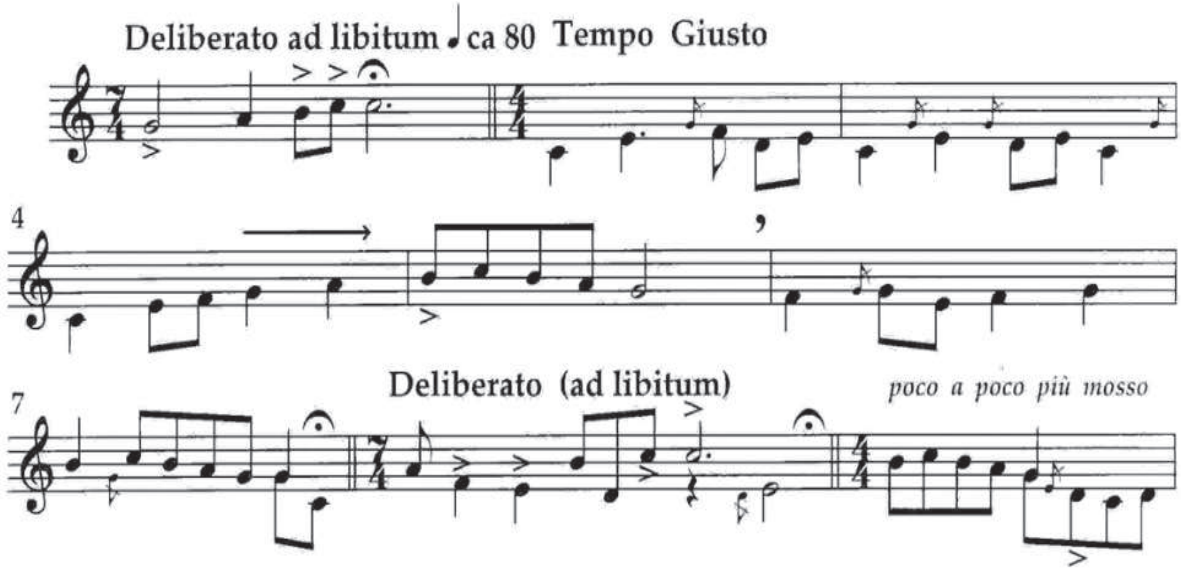
7. AL HASHIGGAION



8. SHIR YEDIDOT



9. AL HASHEMINITE



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